THE

ELECTRICAL REVIEW.

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CABLES AND STRATEGY.

SINCE the laying of the British-owned Pacific cable in December, 1902, events have moved rapidly in the world of telegraphy; and the need for completing the girdle of the globe by a series of cables, all State-owned and State-operated, continues to be a matter of discussion throughout the Empire. It is a theme that can easily be employed to stir up healthy sentiment, for it suggests an effort to strengthen the ties between the scattered peoples of the King's dominions, and it leads naturally to a desire to improve the defences of the Empire by extending, widening and securing the lines of communication. In 1901, for example, the Ottawa Board of Trade addressed to various bodies representing trade and commerce, a circular letter expressing their conviction that—"The British possessions throughout the world should be directly connected by State-owned cables under the control of the Post Office." They urged that it would be the means of fostering trade and stimulating commercial activity, and that it would be "a bond of Imperial unity of inestimable value." This appeal was not in vain. Earl Grey, then Governor-General of Canada, paid a high tribute to Sir Sandford Fleming who, for a quarter of a century, had devoted his energies to cheapening the telegraph service of the Empire and to developing an all-Red cable system, when he expressed himself as being hopeful that the advocates of such a system would soon find their ideals realised. Good work was also done by Sir Charles Tupper and by Sir E. Sassoon in furthering this endeavour, and they succeeded in the praiseworthy task of securing communication between the Mother Country and British territories bordering upon the Pacific. It was a substantial beginning to an all-Red line; but there the scheme stopped. Almost 12 years have elapsed since that British Pacific cable was laid; and it remains—a link, and nothing more. It is reasonable to inquire whether that isolated link is to form part of a chain, or whether it is to be left as a reminder that in the twentieth century the Empire lacked statesmen of knowledge and force enough either to complete the work of the men who by common consent had a clear notion of how an Empire should be developed and defended, or to declare the work of those men to be misconceived and futile.

When sentiment is given its appropriate place—that is to say, when it is admitted as an impelling force, but not as a guide to policy—it has to be admitted that there are two sides to the question of constructing a universal network of cables all State-owned and State-controlled. The case, from the point of view of the convinced advocate of State control, is admirably summarised in an article in the current *Quarterly Review* by Mr. Charles Bright, but the article would have been considerably enhanced in value if the arguments of those in favour of private ownership had been stated and discussed more fully. Mr. Bright says that inter-Imperial telegraphy should not be regarded merely from the financial standpoint. He points out that the inland telegraph system of the United Kingdom is conducted at a loss, and he asks us to believe that the loss is justified by the advantages accruing to the public. He urges, in fact,

that inter-Imperial telegraphy serves national, Imperial, and strategic ends, and that it acts as a powerful help to inter-Imperial trade. What the public really want to know, however, is why it is necessary to conduct State telegraphy at a loss, to what extent the loss is due to mismanagement, and to what extent it is the result of the evils of vote-catching by successive Governments. When the history of the loss is studied, it is seen to be but sorry evidence in favour of State-ownership. Fortunately the case for State-ownership can be placed upon firmer and higher ground, for there is no valid reason why State-owned cables should not be operated as successful commercial undertakings.

Mr. Bright uses the old argument of the strategic value of submarine cables with considerable effect, and there can be no doubt that this aspect of the matter deserves careful attention; but here, again, he leaves out of account some points of extreme moment. He rightly says that the mere fact that a cable is landed on British territory does not meet the important requirements of constant control, but he falls into the error of supposing that "such control is ensured by ownership and self-management alone." When contemplating a condition of war, as in this instance, the word "control" acquires new and vital significance. In war, ownership and self-management do not give control; in war, on the contrary, it is control which gives ownership, and it is defence alone that gives control. In other words, a State-owned cable would require defending no less, but perhaps rather more, than a private-owned cable. From the strategic standpoint, a State-owned cable has, nevertheless, exceptional value, for its landing places can be selected at points along a coast easy to defend; and, moreover, State ownership ensures that the precise route of the cable is known to the State, and that consequently, in time of danger, there is at least a chance to pick it up, where possible and desirable, and to transfer it, if necessary, to a landing place unknown to the enemy. There is good reason to study by every possible means to secure the financial soundness of any State-owned cable scheme that may be put forward within the Empire; for the cry is, as in the days of the early railway negotiations, that a monopoly has been given to private owners, and that the people are the victims of the bargain. If a State-owned cable is to be used fairly to break down an apparently unfair rate, it should itself be shown to be a financial success when working at the reduced schedule. Unless this criterion is applied, the project degenerates into the old game of vote-catching, which has made State ownership in general what it is.

Under modern conditions, it is probably not in time of war, but during the days or moments immediately preceding war, that cables and wireless telegraphy would have their main strategic value. In time of war we must be thankful if we have them working; but it would be prudent to reckon without them. The State-owned cables would probably carry us a few hours further into the stress of things than the private-owned cables, and their strategic importance would thus be greater. In the circumstances, therefore, it is remarkable that so little progress has been made with the all-Red scheme. It becomes even more remarkable when it is remembered that in December, 1902, the submarine cable industry was almost entirely in British hands. To-day the total length of submarine cables is about 280,000 nautical miles, of which 230,000 nautical miles are worked by private companies, and about 50,000 nautical miles by Government administrations. The State-administered cables of Germany, Spain, France, Japan, the Dutch East Indies, and the United States, together amount to rather more than 26,000 nautical miles; the Pacific Cable Board is accountable for 7,837 nautical miles, but Great Britain and Ireland own less State-administered cable than any one of the countries here-named. We may safely entrust this question of strategy to the Committee of Imperial Defence. It suffices here to have shown that if State-owned submarine cables are essential to readiness for war, Great and Greater Britain are at a disadvantage. A more cheerful view of the matter may perhaps be taken when the Dominions Royal Commission, which is now seeking evidence throughout the Empire upon this and allied matters, has completed its task; for, judging from the report so far published, it is doing its work in a very thorough-going manner.

THE COST OF A STRIKE.

At a time when the industry with which this paper is concerned is threatened with a Labour war, it may be useful to consider a few points which are not often brought to the minds of those engaged in the fray.

A strike may be disastrous to both masters and men, and should not be embarked upon lightly.

We often wonder whether the average working man is really very much concerned with the so-called "policy" of those who order him to throw down his tools and come out on strike. "You and I" take a certain amount of interest in politics. We rejoice or lament over the defeat or return of a particular candidate; but the victory or defeat—even of a Government—makes but little difference to our daily life. We fancy that, notwithstanding the reported speeches of the Labour leaders, the average working man is as little concerned with the agitation carried on by the officials of his Union.

When war is declared by the Labour leader, and a strike or lock-out supervenes, we are persuaded that five out of six workmen are reluctant to abandon regular employment and good wages. Although the agitator who makes his living by agitation does not dwell much upon the subject, the cost of a strike is great, and notwithstanding numerous endeavours at concealment, it is gradually becoming known to those whose wages are being continually taxed to provide strike funds. Let us look, for a moment, at a few of the items on the debit side of a Trade Union balance-sheet. When a strike commences the income of the Union, of course, is reduced, and it may come to a full stop.

To provide strike pay it becomes necessary to sell land or realise other investments. A forced sale generally means a low price. Nor do the strikers by any means recover in the form of strike pay the whole of their contributions to the Union funds. There is a continual drain on the exchequer even in the piping times of industrial peace. Offices have been built or rented regardless of expense. A secretary has been paid a handsome salary which, when joined with the perquisites of his office, enables him to make a very comfortable living. Numerous clerks, albeit they are probably not paid at Trade Union rates, have been drawing weekly emoluments for doing clerical work. Then the Union funds have been disappearing in other directions. Loans or gifts have been made to other Unions. Delegates have been sent to congresses, and their expenses, including the expenses of their lunches (the latter being, we understand, rather a heavy item) have been paid. Finally, large sums from the Union funds have been devoted to political propaganda purposes.

The whole cost of a strike, however, is not to be ascertained by a glance at a bank pass book on either side of the conflict. There are many other items of expenditure or loss which, though not so apparent as entries in a cash book, are none the less real.

A strike inevitably tends to encourage the use of labour-saving machinery. The employer tries to get his own back in one way or another. It also tends to divert orders. If it is known that there is no work being done at factory A owing to a strike, those who want electrical machinery will apply to factory B, and if the goods supplied are suitable and the price reasonable, factory A may run the risk of losing a customer for good and all. An instance of "diversion of custom"—to use that phrase metaphorically,

occurred in the recent Dublin strike. Carting goods has been the life work of hundreds of waterside characters in Dublin. Obedient to the orders of James Larkin, these men threw up their work or refused to handle tainted goods some five months ago. What was the result? Anyone walking down Long Acre during the last few months of 1913 might have seen the unwonted spectacle of brand new heavy motor lorries emblazoned with the names of well-known Dublin firms coming forth from the premises of various dealers. Those lorries have been shipped to the Irish capital, to the permanent injury of the foolish men who have listened to the vapourings of an irresponsible agitator.

In "counting the cost" there is one other matter which the would-be striker would do well to bear in mind. Two great strikes have recently occurred in the United Kingdom in which the men have been hopelessly beaten. It has been shown that in the unskilled labour market, at any rate, a strike can be broken by a little determination on the part of employers. It may well be that the employers in other trades, profiting by the example of these other disputes, may determine to fight to a finish whatever the cost. And there can be no two opinions as to what the end will be.

Central Station Salaries.

THE daily Press has been making more or less sensational "copy" during the past week on the prospects of London being without light and power, tramways and tube railways, consequent upon the threatened strike of electrical workers. It has been led to adopt that course by information supplied to it by somebody or other to the effect that the central-station men controlling the power stations would "in all probability support" the members of the Electrical Trades Union in the event of the latter downing tools. Only a mind that knew very little of the A.E.S.E. and of the men it represents could fall into such an error. And yet we ourselves confess to having been led last week into questionings regarding the course adopted by the central-station men. We cannot forget that the proceedings at the mass meeting of the E.T.U. last week began with the reading of two advertisements, one for an assistant engineer for a hospital, and the other for an improver for a switchboard, both carrying very absurdly low remuneration, and that the chairman said that "this is the thing the E.T.U. set out to combat in 1889." We may be permitted to question the accuracy of that statement—1889 is a long while ago. Nor do we forget either with what rounds of applause the mass meeting of workers received the announcement by a subsequent speaker, to the effect that the "Association of Electrical Station Engineers are going to collaborate and co-operate with the E.T.U. in any policy or method which may be deemed desirable to deal with this particular body of employers." Now we think that this was quite enough to mislead even ourselves as to what the central-station men were prepared to do in certain eventualities. We suspect that the terms in which the statement was made were quite unauthorised, and that the E.T.U. was making the most of the prestige-giving connection with the A.E.S.E. To some minds the fact that the secretary of the A.E.S.E. seconded the amendment on the following night may have suggested that the agreement between the two organisations was not an imaginary one. We believe, however, that the intention in the main was to get the masters' resolution out of the way. That end was attained. The scale issued by the E.T.U. included "shift engineers £3 per week." How many such men are members of the E.T.U.? The London Electrical Masters' Association Committee included several representatives of electric supply authorities (we learn that they have since retired), but London central-station workers were not properly represented in the hall, and the attitude was correctly taken up that the meeting was incompetent to deal with the terms and conditions of employment for such officials. This consideration doubtless influenced the secretary of the A.E.S.E. in seconding the amendment, but how the A.E.S.E. is going to act with authority in negotiating with the L.E.M.A. concerning wiremen's wages and conditions we fail to see. It is hardly for us to say what the A.E.S.E. should do under all the circumstances, but we may express the opinion that the Association stands to gain more for its members both in status and in remuneration, by continuing to pursue its original methods. It will do its cause little good by encouraging a sensation-loving Press to lead an impressionable public into believing that central-station staffs are going to leave the community without its electrical life-blood. London is not Paris, and our central-station officials would be ill-advised to follow the example of Herefordshire schoolmasters.

The Half-Watt Lamp.

OUR "Correspondence" columns this week afford ample evidence, not only that the arc lamp is not "dead," but that arc lamp makers are very much alive—and kicking. When we offered a welcome to the half-watt lamp, we indicated roughly the position that it would occupy in comparison with the flame arc, not with a view to disparaging the latter or suggesting its extinction, but rather to define the respective spheres of utility of the two types of lamp. We clearly stated that the flame arc lamp had the higher efficiency, and that where energy cost more than 1d. per unit the flame arc would be the cheaper, and we allocated to the half-watt lamp the lighting of streets where the flame arc would be too large a unit. Unfortunately, arc lamp makers appear to think that we have over-stated the merits of the half-watt lamp, and to suspect us of unduly favouring the latter. In point of fact, it is a matter of indifference to us whether one or other is preferred; provided that a lamp is *electric*, we are content, and as we do not wish to be forced into the position of "taking sides," we refrain from working up the case for the half-watt lamp, though, notwithstanding the excellent figures put forward by one of our correspondents for the flame arc, there is much that could be said on the other side. It will suffice for us to point to the great development already achieved with the one-watt lamp, and to remind our readers that local conditions will always have an important influence in deciding the choice of lamp, apart from efficiency and cost. There is plenty of room for both.

Mr. Solomon questions the validity of his own figures. We took these from the report of the discussion in the *Journal* of the Institution, which is usually submitted to the speakers for revision before publication, and as they were identical with our own report, we had no reason to suppose that they were hasty or unreliable; so far as we are aware, no one but the author has questioned their accuracy at the time.

As regards the "errors" suggested by Mr. Solomon, we did not lose sight of the points mentioned. The filament of the half-watt lamp is concentrated into the smallest possible volume, so that as a light-source it approximates to an arc, and using "suitable globes or reflectors" the half-watt lamp lends itself admirably to scientific distribution of the light according to the requirements of each case, without great loss of efficiency.

The cost of renewals was dealt with in the last paragraph of our note. Not only do we expect the life of the half-watt lamp in practice to exceed the average named by the makers, but also, in the light of past experience with all kinds of lamps, we look for reduction in the price as manufacturing conditions permit of it.

THE DEMANDS OF THE ELECTRICAL TRADES UNION.

By R. W. WEEKES, Whit. Sch., A.M.Inst.C.E., M.I.E.E.

As requested by the Editors, I have carefully studied the demands of the Electrical Trades Union, as recently issued, and compare them below with the rules which have been adopted by the Electrical Contractors' Association, and which bear the date January, 1912.

To facilitate comparison, the two sets of rules are divided into sections and placed side by side, which enables the new demands of the Union to be easily seen.

In this article I propose to deal with wiring work only, as to widen the scope to charge electricians makes the field to be covered too large.

Working Rules for the Employment of Workmen by Electrical Contractors in the L.C.C. Area.

Adopted by the Electrical Contractors' Association.

Area.—The area under which these rules shall obtain is to be taken as the area covered by the London County Council.

Working Hours.—The recognised minimum working hours are those of the London Master Builders' Association, namely:—

The minimum working hours in Summer being 50 per week for 39 weeks.

During 13 weeks of Winter, commencing on the second Monday in November, the minimum working hours being 44 per week.

Wages.—The following are the recognised minimum rates of wages, and shall be observed as such:—

Charge hand	10d.	
Ordinary wireman	9d.	Mate or general labourer, 6½d.
Pipe fitter only	8d.	
Engineer fitter	9d.	
Electrical fitter	9d.	
Cable jointers	9d.	
Plumbers	11d.	

Charge Hands.—A foreman in charge of a minimum of four men shall be recognised as a Charge hand and paid as such.

Overtime.—Overtime shall be paid after a full day's work of 10 hours at the rate of time and a quarter up to 8 p.m., time and a half from 8 o'clock to 10 o'clock, and after 10 o'clock double time. On Saturday, time and a half from 1 p.m. to 4 p.m., after 4 p.m. and Sundays, double time. Christmas Day to be paid as Sundays. Each day to stand by itself.

Night Gangs.—Workmen engaged on a "night gang" shall be paid 1d. per hour in addition to the ordinary rate of wages, provided that workmen on a night gang shall not have been employed during the preceding day. The hours worked without overtime rates not to exceed 10 per day of 24 hours. Meal times during the night to be one and a half hours. Double time to be paid from Saturday midnight to Sunday midnight.

Travelling Time and Expenses.—Out-of-pocket expenses and extra travelling time shall be allowed to men when sent from office or works to the outlying job.

Payment of Wages.—Wages shall be paid on the job, but if otherwise arranged, walking time at the rate of three miles per hour shall be allowed to get to the pay table.

Electrical Trades Union.

London District Working Rules.

1. These Rules shall apply to all contractors, sub-contractors, and their workmen.

13.—The term "London District" to mean a 12-mile radius from Charing Cross.

2. Fifty hours shall constitute a week's work (excepting shift men), but when members are working on jobs where the hours are less, the money shall be made up to equal 50 hours a week. Nine hours shall constitute a day's work for the first five days of the week, and five hours on Saturday.

Rates of Wages.

5. The minimum rates of pay shall be in accordance with the following scale:—

Electrical fitter and wiremen	11d.	per hour
Armature winders	11d.	„
Cable jointers...	11d.	„
Plumber jointers	1s.	„
Joiners' mates	8½d.	„
Meter fixers	£2	per week
Coil or magnet winders	9½d.	per hour

All charge hands to receive a minimum of 1d. per hour extra.

Shift engineers	£3	0	0	per week
Switchboard attendants	2	5	0	„
Accumulator erectors and attendants	2	5	0	„
Power and dynamo attendants ...	2	5	0	„
Arc lamp trimmers	1	18	0	„

The total number of hours worked shall not exceed 56 per week.

3. Overtime worked on the first five days of the week to be paid for at the rate of time and a half for the first four hours, and double time after till starting time next morning. If the work continues after 12 midnight, the member shall be paid up to starting time next morning. Half an hour shall be allowed for tea, and one hour for supper if working after 12 midnight.

All overtime worked on Saturday and Sunday till starting time on Monday morning to be paid for at the rate of double time.

Each day to stand by itself.

No member shall be allowed to work more than one night in succession, viz., that after working one night members must cease work at the usual time of leaving work next day.

No member shall be allowed to work overtime unless absolutely necessary, when members in the district are unemployed.

4. Night-shift work to be paid for at the rate of time and a half, all time worked after nine hours to be paid for at the rate of double time.

6. All members (except inside workers) working over one and less than 12 miles from the shop to be allowed travelling time and third class ordinary railway fares. Country expenses to be not less than 2s. 6d. per day in England, and not less than 3s. per day in Scotland or Ireland. Travelling time and third class railway fares to be paid for the journey from shop to job and from job to shop.

Inside workers shall be allowed walking time for any distance under one mile, and not less than one shilling per day for over one mile and under three miles from shop. Not less than 1s. 6d. per day outdoor money to be paid and travelling time and third class ordinary railway fares allowed for any distance over three miles and under 12 miles from shop.

7. All members working on any dirty job must receive not less than 1s. per day extra. All members working on any dangerous job must receive 2s. 6d. per day in addition to outdoor money.

Members sent to work on jobs on the Continent of Europe must receive not less than 1s. 3d. per hour in addition to £1 10s. expenses.

8. District Holidays to be:—Easter Monday, Whit-Monday, August Bank Holiday, Christmas Day, and Boxing Day. No holiday shall entail more than two days' loss of time. The rate of pay for Bank Holidays shall not be less than time and a half, Christmas Day and Sundays not less than double time.

9. Payment of wages shall commence as soon as practicable after the time of leaving off, and be paid on the job or place of employment; but, if otherwise arranged, walking time at the rate of three miles per hour shall be allowed to get to the pay table. Any workman kept waiting for his wages beyond 20 minutes to receive time and a half for all time kept waiting from the time of leaving off work. Not more than one day's wages shall be kept in hand as back time.

Notice of Determining an Engagement.—One hour's notice to be given on either side. Weekly wage employés to give and receive one week's notice. Wiremen running casing to receive one hour's grinding money.

Apprentices.—All apprentices shall be properly indentured for a term of not less than three years, and all improvers, after serving as apprentice and improver, or apprentice only, or improver only, a total term of seven years, shall be recognised as fully-qualified wiremen or mates, and be paid the full rate as such.

Assistants.—On each job there must not be a greater total of mates, apprentices and improvers than the total of fully-paid wiremen and fitters.

10. One hour's notice to be given on either side on determining an engagement. All wages due to be paid at the expiration of such notice, or walking time if sent to shop. Weekly employés to give and receive one week's notice. Members running casing to receive one hour's grinding money in addition to one hour's notice.

11. Employers shall provide, where practicable and reasonable, the following conveniences :—

(*a*) A suitable place for the workmen to have their meals on the works, with a labourer to assist in preparing them.

(*b*) A lock-up where tools can be left.

(*c*) A grindstone for the use of workmen.

(*d*) The provision of proper sanitary accommodation.

12. Sub-letting for labour only to be prohibited.

No corresponding rule.

14. All members working in shops where the conditions are better than this card demands must uphold the established conditions of the shop.

Rate of Wages.—It will be noticed that the Contractors' Association wages are given as minimum, and it is of interest to see how these, and those now demanded by the Electrical Trades Union, compare with the rates adopted by the London County Council. It must be remembered that this Council schedule what they believe to be the standard wages as agreed between the employers and the Union of the employés in the district in which the work has to be done.

The following schedule shows the three scales side by side :—

Schedule of Wages.

——	Electrical Contractors' working rules, dated January, 1912.	L.C.C. schedules, 1907 and 1914.	Proposed by Electrical Trades Union.
Charge hand	10d.	—	1s.
Ordinary wireman ...	9d.	9½d.	11d.
Pipe fitter only	8d.	—	—
Engineer fitters ...	9d.	9d. to 9½d.	—
Electrical fitters ...	9d.	—	11d.
Cable jointer	9d.	9d.	11d.
Plumber's jointer ...	—	1s.	—
Plumbers	11d.	—	1s.
Mate or general labourer	6½d.	6½d.	—
Joiners' mate	—	—	8½d.
Armature winder ...	—	9½d.	11d.
Coil or magnet winder	—	7d.	9½d.
Hours of labour ...	50 hours for 39 weeks 44 hours for 13 weeks	54 hours	50 hours per week or equal money
Overtime first five days	10 hours' day, time and a quarter till 8 p.m., time and a half 8 to 10, after that double time	9½ hours' day, 2 hrs. time and a quarter. 2 hrs. time and a half, after 4 hrs. double time	9 hours' day, time and a half for first 4 hrs., double time after till starting next morning; if after midnight, must be paid till starting time next day
Saturday...	1 p.m. to 4 p.m. time and a half, after that and Sunday double time	double time	double time
Sunday			
Night shift	1d. extra per hour	1d. extra per hour	time and a half

In my opinion, the "joiner's mate" in the Union's schedule is a misprint for "jointer's mate," and the wage asked, high for a labourer. In favour of the men it must be noticed that the schedule rates as accepted by the L.C.C. have not altered since 1907. In the same interval the other trades given in the L.C.C. schedules have gone up as follows :—

	1907.	1914.	Increase %
Carpenters	10½d.	11½d.	9·5
Plumbers	11d.	1s.	9·1
Smiths' fitters, hot-water fitters and gas fitters... ...	9d. to 10d.	9½d. to 10½d.	10 5
Engineer fitters ...	40s. to 43s.	40s. to 43s.	No change.

On the same basis the Electrical Trades men should be entitled to an increase similar to that obtained by the gas fitter, which is 1d. per hour.

I fail to see the grounds for the demanded alterations in overtime payments for the first two hours, as the present standard is accepted by most other trades. The demand for an increased rate per hour in the winter when, due to limited daylight, the working hours have to be reduced in building trades, in my opinion, makes estimating impossible. Also the demand for payment at double time for hours not worked if employed at all after midnight, is one that requires some modification. Thus, if the wireman stays until 1 a.m. to finish an urgent job, the Union asks that he should be paid for that hour 11s. On the other hand, it is not fair to turn a man off at 2 a.m. in London and expect him to start at ordinary rates at 6 a.m.

The night shift is not often wanted for wiring work, but there are cases where rewiring must be done after business hours. An increased cost of 40 per cent. seems to me to be prohibitive in such cases.

Grading.—The demands of the Union neglect the individual value of the employé, except in one small paragraph to the effect that a man receiving more than is now asked shall not be reduced when the wages of inferior workmen are increased. It is this difference in value which, in my opinion, has kept many of the best men out of the Union and enabled them to get now more than the standard rate of 9½d. per hour. The Union has suffered in two ways; first, by the lack of the support of these men; and, second, by having to pay the lower grade men unemployment benefits, as these men are naturally the first to be out when the wiring business is slack.

The London County Council rates recognise grading in trades such as hot water and gas fitting, and the subject is one which the Union could handle more effectively than the contractors, as its records should show what men by their superior knowledge of their trade can secure constant employment.

By establishing at least two definite grades, and taking care to admit only well-trained and responsible men into the upper grade, the Union would find its membership increase more rapidly than by a public attempt to get maximum wages for all, irrespective of the capability of the individual member.

Apprentices and Improvers.—It is through such training that the best workers are obtained, but this becomes absurd if the apprentices are not working with skilled men. The proper proportion of skilled men to apprentices and improvers should now be agreed definitely, and the contractor who evades such an agreement should be dealt with by his fellow contractors and by the Union. The pressure from

fellow-contractors, supplemented by difficulties in obtaining skilled labour for special work when needed, should effectively check the infringement of the rule when settled.

To conclude the matter, it must be remembered that it is not the contractor who really finds the wages, but those members of the public who require electrical work done. Any increase is bound, after a few weeks, to raise the price of electrical installation work, and if the increase is unduly large, must reduce the quantity of work to be done.

In my opinion, a general increase of wages is warranted, but before it is given the following points should be settled, to ensure more harmonious working in the future :—

(*a*) The increase to apply equally to all employés, according to their grades, which at first might be assumed to be in accordance with their present wages.

(*b*) All contractors to accept this, and make a corresponding increase in their estimates.

(*c*) The proportion of apprentices and improvers to skilled workers on all jobs to be agreed.

(*d*) The contractors to deal strongly with any firm who cut prices by using only apprentices and improvers to do work.

(*e*) The Union to take up strongly the grading of their members, and to guarantee that the payment of a subscription shall not be the chief claim to membership.

I believe that speech-making is of no service whatever at the present time to either side, but that a small committee of men and employers, with an independent man as chairman, could settle the whole matter in a few hours. The representatives should be chosen because they are workers, not talkers, and the decision come to should be circulated as one document to all interested, without comment from either side. A ballot by post would prevent a recurrence of the speech-making, some of which, if reports are to be believed, has been equally discreditable to both sides. I believe that in this way a prompt settlement to the real interest of electrical business can be arrived at.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Half-Watt Lamp.

With reference to your Editorial notes in your issue of the 16th inst., we have heard so many times in our life that arc lamps are dead, that we have begun to doubt the possibility of their decease.

When metal-filament lamps were introduced we were told that enclosed arc lamps were doomed, though a few flame lamps might still be sold. That the demand for the enclosed type diminished is perfectly true, but the fact remains that we have sold very large numbers of them, and are still doing so.

The half-watt enclosed arc lamp as now made by us has equal efficiency and far better colour and lower intrinsic brilliancy than the half-watt metal-filament lamp, and as the life of these lamps can be put at least at ten years, with a nominal cost for repairs, with approximately the same initial cost as the half-watt metal-filament lamp, the latter is at a serious disadvantage. We should not like to ask our customers to buy an arc lamp every year, the maker of the half-watt metal filament must.

Of course, there is a public which says : "Hang efficiency," and only thinks of convenience and saving of trouble ; even many central-station engineers use metal-filament lamps for outside shop lighting for this reason, when they ought to supply a lamp giving the most light at a minimum expenditure of energy, but you talk about efficiency, so cannot take up this position. The same short-sighted policy of some station engineers at the introduction of the metal-filament lamp has been the reason for many installations of high-pressure gas.

No metal-filament lamp lighting has yet been introduced giving results comparable to those of the best flame or enclosed arc lamps.

Referring again to the efficiency question, the metal-filament lamp generally gets so dirty that its efficiency is very much reduced, and we once heard an enthusiastic user, after declaring that he would not bother with the trimming of arc lamps, say that he cleaned his metal-filament lamps every day ! He might just as well have spent his time in trimming arc lamps periodically only, and so have obtained a great gain in efficiency.

Even the man in the street has begun to notice the quick falling off in the brilliancy and the increased dirtiness of the globes in metal-filament lamps, more particularly for outside use.

For inside use where the matching of colours is under consideration, the enclosed arc lamp has nothing to fear from the competition of the half-watt metal-filament lamp.

We have mentioned the question of enclosed lamps particularly because it is obvious that most of the arguments in favour of these lamps are threefold more powerful when considering the flame type and the use of larger units.

per pro. **Engineering and Arc Lamps, Ltd.**
J. S. HECHT, *Director.*

St. Albans, *January 30th*, 1914.

With reference to your notes under our letter of the 23rd ult., on page 171 of your issue of the 30th ult., we would say that in taking the figures of Mr. Solomon's paper of nearly two years ago, for your comparisons of arc and half-watt lighting, you have omitted to take into consideration that the flame arc lamp of to-day is a great advance upon that of two years ago, and the comparison, therefore, is unfair.

The improvements in the present-day magazine flame lamp manufactured by us, as compared with its predecessors, are its higher efficiency (eight candles per watt), longer hours of burning (150 hours), complete freedom from deposits on globe interiors even after 300 hours, if required, the use of cheap and higher efficiency carbons, lower cost of maintenance, and chiefly in the formation of the polar light curve, whereby the greatest amount of light is given at a narrow angle from the horizontal, making for an efficient distribution of the light. This chief improvement has been brought about by, amongst others, the controlling of the special formation of the flame. A lamp as described above will give at 20° from the horizontal an actual net candle-power of eight candles per watt.

The costs of running a 400-watt lamp of this type for 4,000 hours per annum would therefore be :—

400 watts × 4,000 hours, at 1d. per unit ...	£6	13	4
34 trims, at 3d. per trim	0	8	6
Carbons, at ·125d. per hour	2	1	8
Interest on capital and depreciation, say ...	1	10	0
Replacements and attendance, say	0	10	0
	£11	3	6

For street lighting, therefore, it is quite admissible to regard this lamp as one of 3,200 candle-power, since this is given at the angle most necessary to increase the minimum illumination.

From these figures it will be immediately evident, by a rough calculation, that the half-watt lamp will bear no comparison whatever in point of cost for light delivered with the flame arc, presuming the same number of light units to be employed.

In comparing the two forms of lighting of flame arcs and the half-watt lamps, a further advantage accrues to the former, inasmuch as the polar curve of the latter is really unsuitable for street lighting.

We think you must be incorrect in stating that "the actual recorded average life" of the tungsten 1-watt lamps in street lighting is "several thousand hours," for on inquiry we are informed by one of the actual manufacturers that, at any rate for the high-candle-power lamps (which are those in question), the average life is 1,200 hours, and we cannot assume an average life of several thousand hours for the half-watt lamp when only 800 to 1,000 hours are claimed at present by the makers.

Since you mention the Holborn lighting as an example, we give below figures based on the same number of half-watt lamps having 1,000 hours' life each, instead of the 1-watt lamps actually employed, compared with 120

modern magazine flame lamps of 400 watts consumption each, at 30 yards apart, the minimum illumination of the latter being, we approximate, more than double that of the half-watt lamps. Taking 4,000 hours of burning for each per annum, the costs would be as follows :—

Half-Watt Lamps.				*"Oliver-Pell" Magazine Flame Lamp.*	
20 ½-watt lamps 1,800 C.P., 72,000 units, at 1d. ...	£300	0	0	120 400-watt lamps, 192,000 units at 1d.	£800
212 ½-watt lamps 400 C.P., 169,600 units, at 1d. ...	706	13	4	Carbons for 120 lamps, per annum, at ·125d. per lamp per hour ...	250
80 ½-watt lamps 1,800 (2,000) C.P., at 40s. each ...	160	0	0	Interest at 5 per cent. per annum, and depreciation at 10 per cent. per annum on capital cost of, say, £1,200 ...	180
848 ½-watt lamps 400 (600) C.P., at 24s. each ...	1,017	12	0	Trimming, at 8s. 6d. each	51
Attendance and cleaning, say 5s. each	58	0	0	Replacements and attendance, at 10s. each ...	60
	£2,242	5	4		£1,341

The saving by use of flame lamps, therefore, would be £901 5s. 4d. per annum.

As you will see, no interest on capital for lanterns, nor depreciation, nor breakage of lamps, &c., have been included in the case of the half-watt lamps, so were these items to be added, a still further saving could be shown by the flame arc lamp, and if "light for light" figures were taken, the saving would be enormously increased.

The more one thinks about the case, the more striking is the comparison in favour of the flame lamp, for the metal-filament lamp will admittedly have an average lower candle-power than its initial candle-power; and, further, if losses by absorption be considered, the comparison is still more striking.

We admit that the half-watt lamp will have its uses for side street lighting, where efficiency is of secondary importance, but we venture to repeat that where really efficient street lighting is required, it cannot possibly compete with the modern magazine flame lamp.

Trusting you will find space for so long a letter in your next issue,

Oliver Arc Lamp, Ltd.,
Wm. D. Pell, *Director.*

London, E.C., *February 3rd*, 1914.

I notice that in your issue of January 30th, in an editorial foot-note to Mr. W. D. Pell's letter, you quote, as authority for your comparison between the flame arc and the ½-watt lamp, some figures which I gave in the discussion on my paper on "Yellow Flame Arcs" in May, 1912. I would like to point out that these figures, which were given in reply to a point raised by one of the members, were worked out on the spot and do not therefore pretend to any great degree of accuracy; nor was it necessary in making a comparison between the flame arc lamp and the 1-watt tungsten lamp to figure the costs very closely, the margin in favour of the flame lamp being so very great.

It seems to me, therefore, unfair to use these figures as a direct basis for a comparison such as you made, and I think that in doing so you have fallen into two errors.

In the first place, if these lamps are to be compared as suitable light sources for street lighting, a comparison must be made on the basis of mean lower hemispherical candle-power, using in each case suitable globes or reflectors, a consideration to which I refer in the discussion which you have quoted, pointing out that the comparison on such a basis will be more favourable to the arc lamps.

The second error is to take my figures for the cost of lighting with one-watt tungsten lamps, and to convert these to figures for half-watt lamps by merely halving the cost of energy, omitting, therefore, to take into consideration the fact that the lamps themselves will be dearer, and the cost of renewals, &c., will undoubtedly be higher.

Maurice Solomon.

Witton, *February 2nd*, 1914.

[We refer to this subject in our leading columns to-day.—Eds. Elec. Rev.]

Continuity of Supply.

In reply to the letters of Mr. Watson and Mr. Nevill in last week's Review on the above subject, I should like to say that the misrepresentations of facts of which they accuse me, are hardly as glaring as they would have your readers believe. The facts upon which my first letter was based, I have every reason to believe are substantially correct. I enumerate them below :—

1. Bury.—It is admitted that the salaries paid by Mr. Watson, as stated in his letter, are quite up to the average, *i.e.*, 45s. to 50s. for shift engineers, but didn't he advertise for a shift engineer at 35s. only a few months ago? Upon this fact was my assertion made.

2. Wakefield.—Until some little time ago, the commencing salaries for shift engineers and switchboard attendants were 30s. and 10s. respectively; the fact that they are now 35s. and 15s. proves that things are looking up even at Wakefield, although seeing that the maximum load is over 1,500 KW., there is still room for improvement in the switchboard attendant's wages.

3. My grumble against the other concerns I mentioned was in reference to the practice of putting improvers in charge of shift in sub-stations where the capacity of the plant in many cases is from 2,000 KW. to 3,000 KW., and paying them the princely sum of 15s. to £1 per week.

In conclusion, I should like to assure Mr. Watson that I am not one of the down-trodden few, as I happen to be employed by a chief whose regard for the welfare of his men is at least equal to Mr. Watson's. I am, however, alive to the fact that the status of station engineers is not what it ought to be, and only by the united action of all shift-men, whether well paid or poorly paid, can we hope to succeed in improving their status.

Shift Engineer.

I read with interest "Shift Engineer's" letter in your issue of the 23rd inst., and heartily agree with all he says regarding the working conditions of shift men. But what about the working conditions of mains engineers? I am sure that if these men were to state their case, it would be found to be considerably worse.

The majority of mains engineers are required to locate themselves so as to be readily got at in case of emergency—many even having telephones in their houses. They are called out in all kinds of weather, at all hours, and have to do long spells without food. They also have to stand no end of abuse from consumers, &c.; their wages are little better than a shift engineer's, and they cannot be said to have any time of their own, while the shift men are at least free when off shift.

I know of a good many mains engineers in the employment of several large power companies in England and Scotland whose life is hardly worth living, and I should be pleased to hear them express their views on this subject.

While the A.E.S.E. has done a considerable amount of good work towards bettering the conditions of shift men, up to the present I have seen no attempt on its part to better the conditions of mains men. What this may be due to I cannot say, but perhaps Mr. W. J. Ebben will be in a position to explain.

One of Them.

London Electrical Trade Dispute.

The suggestion that the A.E.S.E. had thrown in its lot, or amalgamated, with the E.T.U. is without foundation.

The Press have greatly exaggerated the fact that the Hon. Secretary of the A.E.S.E., as a representative of employés at the London Electrical Masters' Association meeting, seconded a resolution proposed by a member of the E.T.U. (also a representative of employés), the gist of which was to refer the negotiations with regard to working rules and terms and conditions of employment of *all* electrical workers in the London district to the two organisations concerned, viz., the A.E.S.E. and the E.T.U.

Any statements with regard to future developments of the A.E.S.E. in conjunction with the E.T.U. are entirely premature.

W. J. Ebben,
Hon. Sec., A.E.S.E.

London, *February 2nd*, 1914.

The letter in your issue of last week, over the nom de plume "Employer," shows the spirit which makes the amicable settlement of differences between employer and employed impossible and so justifies Trade Unionism.

It strikes one very forcibly after the conciliatory tone of your leading articles that his statement that if the rules he mentions were drawn up with the idea of getting the men the sack they could not have been better, shows him to be of the type of employer who does not consider the welfare either of the trade or of his workers. Every man who judges the question impartially must admit that the wages paid in the electrical trade are scandalously low compared with other trades; personally, I am almost ashamed to say I am an electrician, though I like the line; but apart from comparisons with other trades, the increased cost of living is alone sufficient to justify the men in asking for an advance.

As to hours, I think 50 hours per week is the recognised rule for electricians and wiremen, and has been so for many years, at least by all the leading contractors. Perhaps he would like to tell us what he objects to in that; is it too many hours, or is it that he wants to keep his men as long as he likes without paying extra time? Or perhaps he has calculated that if he has three men and works them 12 hours a day instead of nine, he saves the amount of one man's State insurance.

"Dirty Money" is recognised by many employers and is perfectly justifiable in some cases, but it is a point that wants making clearer, or we may have wiremen spending their dinner hour up the chimney. Another rule that "Employer" objects to is on travelling expenses; he is at his best there. Just fancy a wireman following his work; he would need a caravan, and I suppose if he was on a job more than a couple of hours, he would have the police after him.

It seems to me only fair that a man should be paid his expenses, if he is sent a distance, and a shilling for time and fare for a three-mile journey isn't exorbitant. Another point about that is that it tends to keep work in local hands. The suburban rate of wages is generally lower than the London rate, as also are rent, rates, &c., and without any expenses to pay the suburban contractor could undercut his town rival every time, but if this rule is enforced he must either pay London rate or suburban rate plus expenses.

I have not seen the rules other than those in "Employer's" letter, and I am not in the Union. I am with you in hoping that this question may be settled without any trade disturbance, but if all the masters are like the one who wrote the letter quoted, we shall only obtain what is fair by combining.

C. S. Smith.

London, *February 2nd*, 1914.

Cost of Living in India.

In answer to a query on the above in your issue of November 7th, 1913, I may state that Calcutta or any part of Bengal is not exactly a health resort.

There are few comforts to be obtained except at exorbitant prices. A European has either to be a "sahib" or a "nobody," as there is no middle class here.

Your correspondent should see that his agreement is not one-sided, and that it can be broken on the payment of a penalty on either side. The minimum amount on which a bachelor should come out here is 500 Rs. (equivalent to £33 6s. 8d.) per month.

'Ad Some.

Calcutta, *January 13th*, 1914.

Protection or Tyranny?

In your issue of January 30th, I was particularly interested to notice, in Mr. Purse's letter, that he corroborates the statement one frequently hears at the present time—that so many orders for plant are being placed abroad, rather on account of the conditions under which members of the B.E.A.M.A. are willing to contract than on account of the high prices of British manufacturers.

If such be the case, then either the B.E.A.M.A.'s conditions are unfair, or the engineers and managers of our large public supplies are unwilling to depart from the conditions which previously existed—or both.

The question is not only of great importance to the electrical industry in this country, but is also of considerable interest to the general public (who, in many cases, are the real purchasers), and as most people, engineers and others alike, appear to be lamentably ignorant of the conditions desired or imposed by either side, it would be a great benefit to all parties if you could find room in your columns to publish the conditions of the B.E.A.M.A. as a basis for a general discussion.

Perhaps Mr. Purse would be kind enough to supply them?

Pollux.

February 2nd, 1914.

STRIKES AND CONTRACTS.

[FROM A LEGAL CONTRIBUTOR.]

THE prospect of a strike in the electrical trade necessarily causes the man who has contracts in contemplation or in progress to think of the precautions which may be necessary to avert disaster. His written agreement, of course, may protect him from being sued for a breach of contract which is really brought about by causes over which he has no possible control; but it may be said at once that in the absence of such protection he may be liable to serious penalties for delay, for it has been decided that where the contract makes no mention of strikes the mere fact of delay being caused by a labour dispute does not excuse a breach of contract. For instance, the charterer of a vessel, having undertaken to provide a full cargo of coals, is not excused by a strike of the colliers making it impossible to procure a cargo. Where, however, works have to be erected or machinery installed "within a reasonable time," it is conceived that the supervention of a strike might have effect to extend the reasonable period. In one case a bill of lading specified no time for discharge. During the unloading, a strike occurred which delayed the ship 25 days longer than otherwise would have been the case. In these circumstances it was held that the obligation on the consignees was to unload within a reasonable time, and the obligation was discharged if he unloaded in a reasonable time in the circumstances, assuming that those circumstances, so far as they caused delay, were not caused or contributed to by him.

It is of importance to know what is meant by the word "strike" in its legal sense. It has been clearly decided that a strike includes a stoppage which may have been more or less voluntary so far as the employer is concerned. Thus, a colliery company agreed to supply 4,000 tons of coal to one P. at the daily rate of supply of 16 tons. In the event of a strike the company was not bound to keep up the daily supply. A strike occurred owing to the company's workmen refusing to accept a reduction of wages proposed by the company, and this strike lasted for four months, during which the company delivered no coal. At the end of the strike P. refused to take any more coal. It was held that the strike was equally a strike although caused by a threat to lower wages; that the effect of the strike was merely to postpone deliveries; and that P. was bound to accept the coal remaining undelivered. It was also held that the delay was not such as to entitle P. to consider the contract at an end in the commercial sense (King *v.* Parker 1876, 34 L.T.N.S. 887).

Finally, it is useful for those who contemplate bringing pressure to bear upon a builder to know that he is generally well protected against strikes. For instance, the form of

contracts approved by the Institution of Electrical Engineers contains this Clause (38) :—

Provided always that if by reason of . . . . general or local strikes or lock-outs . . . . the contractor shall have been unduly delayed or impeded in the completion of the work, the engineer shall, on the receipt of a written request from the contractor, grant from time to time extensions, ... and such extensions shall be deemed to be in full compensation and satisfaction for every actual loss sustained, &c.

This clause will operate to protect the contractor who is affected by a strike similar to that which now threatens the electrical trade.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Cooking and Heating Apparatus.

Messrs. Krupka & Jacoby, Ltd., of Chapter Street Westminster, have recently issued a leaflet dealing with some new heating and cooking apparatus, for which they hold the sole agency in this country.

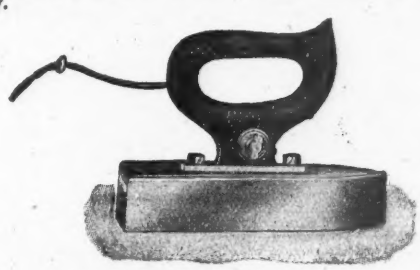


Fig. 1.—The "Perfect" Iron.

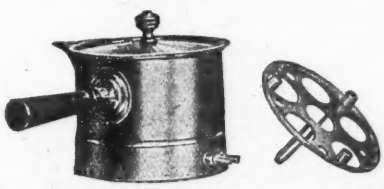


Fig. 2.—Cooker, with Egg-Boiling Attachment.

A variety of cookers, kettles, irons, &c., are listed, amongst which we may draw attention to the electric iron shown in fig. 1, which it will be noticed is fitted with a switch which enables current to be switched on or off locally, thus enabling it to be used with the minimum of trouble. Irons of similar type are supplied suitable for 100/120-volt and 200/250-volt, and are thus available for use on the majority of circuits.

Fig. 3.—Electric Kettle.

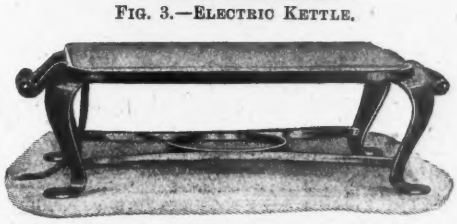


Fig. 4.—Electric Hot Plate.

We also illustrate a cooker with an egg-boiling attachment, a kettle made in either nickel or antique brass finish, and a hot-plate, 12 in. × 8 in. × 4 in. high, which are selected from amongst the apparatus mentioned.

A cheap water heater—the Munditi—is also listed, having a consumption of 200 watts.

A Street Lighting Fitting.

A new "Half-Watt" fitting employing the B.T.H. radial wave reflector has just been designed by the British Thomson-Houston Co., of Mazda House, Upper Thames Street, E.C. The reflector is made of stamped fluted steel, with a reflecting surface of white vitreous enamel. The upper surface is painted green. To accommodate the neck of the Mazda "Half-Watt" lamp, the reflector is fitted with a specially long gallery or housing. The fitting can be used with any form of street lighting post, bracket or cable suspension equipment, and will take any size of Mazda "Half-Watt" lamp.

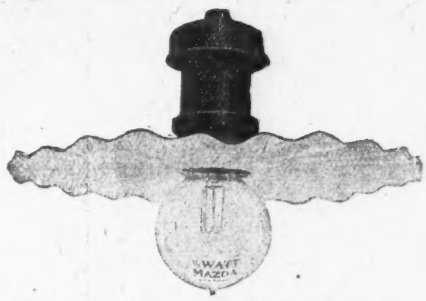


Fig. 5.—Mazda "Half-Watt" Lamp Fitting.

The radial wave reflector projects the maximum candle-power between the horizontal and an angle of 30° below the horizontal, and thus gives a fairly uniform illumination between the posts when they are correctly spaced.

The Ediswan "Downlite" Lamp.

We have received from the Edison and Swan United E.L. Co., of Ponder's End, Middlesex, particulars of their Royal Ediswan "Downlite" lamp, which is made with a separate close-fitting reflector (fig. 6), easily attacted and secured by an adjustable sleeve. The tungsten lamp filament is in the horizontal plane, in one continuous length, of grid form and spiralised, and the combined design of lamp and shade results in a concentration of the light

Fig. 6.—The "Downlite" Lamp.

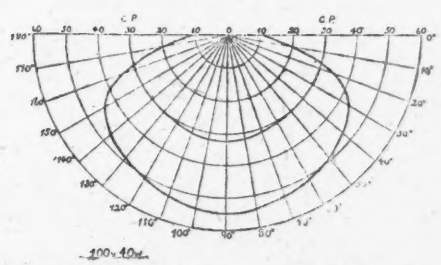


Fig. 7.—Polar Curve, "Downlite" Lamp.

downwards, as shown by the polar curve (fig. 7). While, it is claimed, increased light is obtained where it is frequently most desired, the opal reflector still gives a sufficiency of light in the upward direction.

The lamp and reflector can be placed at any angle required, and the lamp renewals are claimed to cost less with the separate reflector.

Credenda Heating Apparatus.

Fig. 8 shows the type of electrical heating unit arranged for use in the convectors manufactured by the CREDENDA CONDUITS CO., LTD., of Birmingham. The frame, upon which is mounted the heating strips, switches, terminals, and ruby lamps in the case of illuminated convectors, is of standard size, and is fixed in the

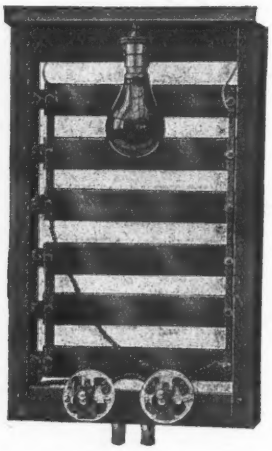


FIG. 8.—CREDENDA HEATING UNIT.

case by the switch rings; clips are arranged in the convector cases to fasten the top of the frame.

The Credenda heating strips are of nickel-chrome alloy wire wound on mica formers with metal ends; connections are made to screws insulated from the frame by steatite bushes.

The heating unit can be arranged for any standard voltage. It is only necessary to send the frame if a convector is required for another voltage.

The Wotan "Concentra" Lamp.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, N.E., are introducing a new lamp called the "Concentra" Wotan lamp, with the filament arranged to give the

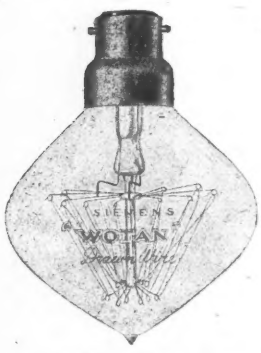


FIG. 9.—WITH PLAIN BULB.

FIG. 10.—WITH OPAL TOP AND RIBBED BULB.

WOTAN "CONCENTRA" LAMPS.

maximum illumination in the downward direction; it takes 30 to 60 watts, at 90-260 volts. Fig. 9 shows how the filament is supported in the shape of a cone in a plain bulb; the same arrangement is employed in the lamp shown in fig. 10, which has a ribbed

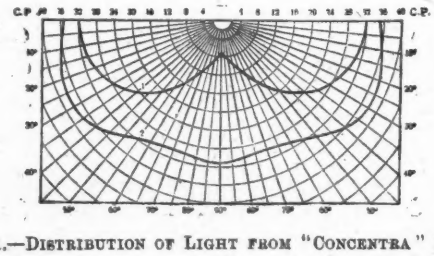


FIG. 11.—DISTRIBUTION OF LIGHT FROM "CONCENTRA" LAMP.

bulb and a white opal top, which further concentrates the light downwards, producing the distribution curve 2 shown in fig. 11, as compared with curve 1 for an ordinary lamp of the same voltage. The improvement in the polar curve for cases requiring a strong illumination is obvious.

Osram "Axial" Drawn-Wire Lamps.

THE GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., have brought out a lamp specially designed to give the maximum illumination in a vertical direction; as shown in fig. 12, the filament is arranged almost at right angles to the axis of the

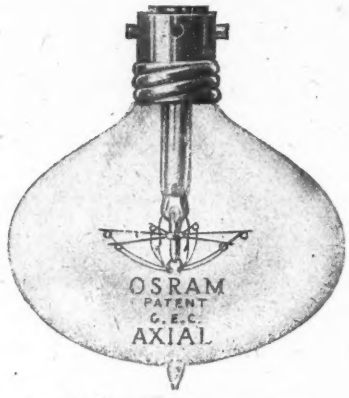
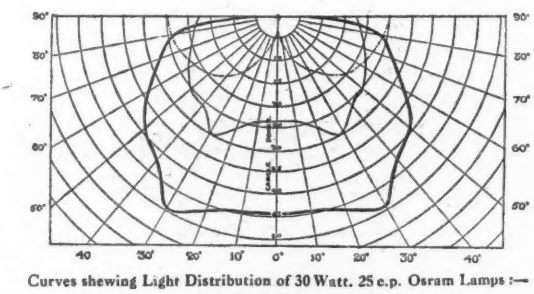


FIG. 12.—OSRAM "AXIAL" LAMP.

lamp, and an opal reflector fitting closely the upper half of the bulb, on which it is held securely by a brass ring, throws down the rays which would otherwise be expended in an upward

FIG. 13.—"AXIAL" LAMP WITH REFLECTOR.

direction. Thus a 30-watt 25-C.P. axial lamp is made to give nearly 50 C.P. immediately below the lamp, over an angle of about



Curves shewing Light Distribution of 30 Watt. 25 c.p. Osram Lamps:—
Osram Standard Lamp without Reflector.
Osram Axial Lamp without Reflector.
Osram Axial Lamp with Reflector.

FIG. 14.—POLAR CURVE, "AXIAL" LAMP.

60°. Where strong downward illumination over a small area is desirable, as over desks, tools, billiard tables, &c., these lamps should be found very effective.

High-Speed Wireless.—High-speed demonstrations in wireless telegraphy were recently given by the Marconi Co. at their Clifden station, and were attended by representatives of the Post Office and Admiralty experts. The rate of speed maintained was 100 words a minute, which was, it is understood, the rate which the company had promised to demonstrate during these experiments. A further working was given at the remarkable speed of 145 words per minute.—*Financial Times.*

LEGAL.

LOUIS SCHLOSS & CO. *v.* CUZNER.

IN the City of London Court on January 27th, before his Honour Judge Atherley-Jones, K.C., a claim was made by Messrs. Louis Schloss & Co., electric lamp manufacturers, 3, Rangoon Street, Crutched Friars, against Mr. Everard Cuzner, 7, Park Road, Wimbledon, to recover the sum of £10 under a guarantee.

Mr. John Morley, plaintiffs' solicitor, said that in October, 1912, they were approached by the defendant with the idea of them employing a Mr. Cullen as their agent to receive and sell lamps in Brighton and the surrounding district. Some negotiations took place, and eventually the plaintiffs said they would not accept Mr. Cullen as their agent without some security for the payment of the lamps which they were going to supply to him. Some negotiations took place, and it was agreed that the defendant should guarantee Cullen's account up to £10. That was put into writing, and defendant wrote and said, "I shall be willing to guarantee his honesty up to, but not exceeding, £10." Cullen owed the plaintiffs various sums amounting to £22, and plaintiffs applied to him for payment, but there was no possibility of recovering it. As the intention of the parties was that the defendant should guarantee Cullen up to £10, the present claim was made.

MR. GUBBINS, defendant's solicitor, said that as there had been no dishonesty on Cullen's part the guarantee became inoperative, and therefore could not be sued upon.

JUDGE ATHERLEY-JONES said he could not see how it was possible for the plaintiffs to go outside the written guarantee, and that unless there had been dishonesty, the plaintiffs could not recover.

MR. MORLEY said that in his view there was an ambiguity about the documents, and there was a doubt as to the intention of the parties.

The JUDGE said he did not think there was much doubt about the meaning of the word "honesty."

MR. MORLEY said that in his view the document was a guarantee on the defendant's part, in the event of Cullen not paying for the electric lamps supplied to him.

The JUDGE said that was not dishonesty.

MR. MORLEY said he was not making any assertion of dishonesty against Cullen.

MR. SCHLOSS was called, and said when the arrangement was being considered between him and Cullen, the word "honesty" was not mentioned, and the form which the defendant had entered into was simply regarded as a guarantee, and not a provision against dishonesty.

The JUDGE said the plaintiff was trying to contradict the written document. Plaintiff wanted to alter the word "honesty" into meaning to guarantee Cullen's account.

Judgment must be entered for the defendant, with costs.

PARLIAMENTARY.

STANDING ORDERS.

CONSIDERABLE progress has been made by the Examiners of Standing Orders in regard to the Private Bills for the forthcoming session. In five cases there has been no appearance before the Examiners, so that the Bills drop. The only two which have any connection with electricity are those of the Brighton and Belfast Corporations, and these to only a very limited extent. The Brighton Corporation had a clause to extend the area of supply for electricity, whilst the Belfast Corporation wanted to borrow money for the laying out of certain lands which it took over when it acquired the Cavehill and Whitewell Tramways.

Newcastle-on-Tyne Tramways.—The Examiners have decided that the Standing Orders have not been complied with in the case of the Newcastle-on-Tyne Corporation Bill, which seeks to enable the Corporation to construct tramways in the Urban Districts of Long Benton and Weetslade, at a cost of about £60,000. The Bill will have to go before the Standing Orders Committee, which will decide whether it shall be allowed to proceed.

Sheffield Corporation Bill.—The Sheffield Corporation Bill, which seeks to extend the city area, was opposed by the Yorkshire Electric Power Co., and Mr. Cripps, for the petitioners, alleged that the notices were insufficient. By Clause 49 it was to be enacted that the local Acts, by-laws and regulations of the Corporation should apply to the extended portion of the city, and further, that the local Acts in force within the added area should cease to be in force. The Corporation could not extend their area without encroaching on the area of the company, and they were actually seeking to deprive the company of the statutory power which they had to supply in the area. Although the company were not at present supplying in the area sought to be included in Sheffield, they intended to do so when their mains were extended.

MR. JEUNE (examiner) found that the allegations were proved, and hence the Bill will now have to go before the Standing Orders Committee.

Yorkshire Electric Power Bill.—The following local authorities petitioned against the Bill of the Yorkshire Electric Power Co., alleging non-compliance with the standing orders:—The Corporations of Halifax, Huddersfield, Sheffield, Morley, Ossett, Leeds, Keighley, Doncaster and Rotherham, and the Urban District Councils of Horbury, Haworth, Southowram, Oxenhope, Slaithwaite, and Cudworth, and the Rural District Councils of Haworth and Cudworth.

The Bill contained a clause that notwithstanding anything in the Act of 1901, it should be lawful for the company to supply electrical energy for all purposes in the district of any local authority or any part of such district within the area of supply which at the date of the passing of this Act of Parliament did not form part of the area of any authorised distribution, and that for the purpose of affording a supply of electrical energy the company should have the power to break up streets and lay cables, &c.

MR. LEES, on behalf of the Horbury U.D.C., said that the Bill was a first-class Bill, giving the company power to break up streets and roads, but no printed copy of the Bill had been deposited at the office of the memorialists as was required by the Standing Orders. He urged that proper notice was of the utmost importance to the road authorities, because the Bill would take away the protection given them by the Electric Lighting Acts.

MR. CRIPPS, on the other hand, contended that the company now had power to break up the streets. The Bill allowed the old conditions with regard to the breaking-up of roads to remain, and the object of the Bill was only to give the company wider powers of supply.

The EXAMINER held that the powers sought were substantially new, and that the Standing Orders had not been complied with.

House of Lords' Bills.—Lord Donoughmore and Mr. Whitley, chairmen respectively of the Committees of the Lords and Commons, have, in conference with the Parliamentary agents, decided in which House the private Bills shall originate. Amongst those which will originate in the House of Lords, are the Bournemouth District Railless Traction, Bristol Corporation Tramways, Hightown Gas and Electricity, North and South Shields Railway, North Metropolitan Electric Power Supply, Poole, Sandbanks and Westbourne Railless Traction, Reading Corporation, Stone Gas and Electricity, and the Yorkshire Electric Power.

BUSINESS NOTES.

Fire-Alarm Successes.—MESSRS. ASSOCIATED FIRE ALARMS, LTD., have sent us particulars of several recent instances of outbreak of fire which were so quickly announced by the automatic alarm installations (Pearson and May-Oatway systems) that serious consequences were averted.

Patent Restoration.—An order has been made for the restoration of patent No. 4,198 of 1905, for "Improvements in clutches," granted to J. H. Apjohn.

Book Notices.—*Handbook on Electroplating, Polishing, Lacquering, Burnishing, Enamelling.* Birmingham: Canning and Co. Price 2s. 3d. post free.—Messrs. Canning's well-known hand-book is now in its fifth edition, and contains 242 pages as compared with 207 in the last issue. We have on previous occasions emphasised the value of this hand-book to the practical man; while it deals mainly with the firm's apparatus and supplies, it is not a catalogue or a price list, and the working instructions which are given are, in great part, perfectly general. Some 36 pages are devoted to the plating dynamo, vats, &c., after which the various metals are dealt with separately, the space allotted to the operation of electro-deposition amounting to nearly 90 pages. A chapter is given to the use of primary and secondary batteries—which are not recommended except for small jobs—and the rest of the book deals with the mechanical processes. Certainly it is a very useful work.

L'Année Electrique, Electro-thérapique et Radiographique of Dr. Foveau de Courmelles (Paris: Ch. Béranger; price 3 fr. 50) is now in its 14th year; as a record of interesting novelties in the electrical world—or worlds, for electricity nowadays has many spheres of interest—the work is unique. Naturally, with such a vast field of labour before him, the author may be excused for such little slips as "la municipalité de Marylbone Lane (Londres)," and Mr. "Wilmskurst," of Derby. He is equally at home with electric chickens and concrete poles; but his main theme is medical electricity, and to this two-thirds of the book is allotted.

L'Electricité Domestique. By Georges Mis. Paris: Dunod et Pinat. Price 2 fr. 50.—This is a "popular" book by an amateur, for amateurs; it deals mainly with the use of primary cells in connection with electric bells, and their installation, together with electric gas lighters, small glow lamps for occasional use, &c., and is illustrated with numerous diagrams of connections and cuts of apparatus.

Spon's Architects' and Builders' Pocket Price Book for 1914 (E. and F. N. Spon. Price 2s. 6d. net.) has this year been published without a diary, in order to afford space for additional matter. The prices are said to have been revised, and several sections have been extended, including the electrical section, which, however, only covers seven pages. As in previous issues, carbon-filament lamps are still included in the prices; several of the electrical tables are identical with those of the edition of 1910, and prices for electric lighting sets are based on the "16-c.p. lamp," which should, of course, be of the tungsten type, but, judging by the prices, is not. While some of the electrical tables are fairly correct, we must say that, on the whole, the prices given are misleading, being in many cases far in excess of the current values.

The Practical Electrician's Pocket-Book, 1914 (London: S. Rentell & Co. Price 1s. net), is 58 pages bigger than the last edition, chapters having been added by Mr. R. J. Wallis-Jones, on Electric Welding, and by Mr. F. S. Grogan, on Electric Heating and Cooking. Many other additions have been made, increasing the utility of the volume, which is now a well-tried and familiar friend, and needs no introduction.

The *Annuaire pour l'an* 1914, issued by the Bureau des Longitudes (Paris: Gauthier-Villars. Price 1 fr. 50 c. net), has been brought up to date, and contains special articles on international time and the deformation of images in field-glasses. There is also a mass of physical and chemical data, in addition to the usual astronomical tables.

In a communication to the *Journal* of the Institution of Electrical Engineers, Dr. T. F. Wall, who in 1912 showed how the circle diagram for the induction motor might be deduced from a consideration of the rotating fields due to the three-phase currents in the stator and rotor windings respectively, applies a similar method of treatment to the development of the circle diagram for the synchronous machine.

Nouveau Guide Pratique de l'Usager d'Acétylène.—By R. Granjon and P. Rosemberg. Paris: Office Central de l'Acétylène. Price 1 fr. 50.—This book is intended to bring together in a handy form for reference all the available information of practical value to the user of acetylene gas, for lighting or heating. It is the second edition of a work issued a few years ago, which has proved very popular in France, where the gas is very widely used. As it is largely founded on replies to questions addressed to the authors by a vast number of users, there should be few difficulties met with in the application of acetylene to lighting and heating that cannot be solved by reference to its pages. Other applications are only briefly touched upon.

The Hill Publishing Co., of 6 and 8, Bouverie Street, E.C., who are just issuing a number of new electrical handbooks, have sent us their new catalogue of technical and scientific books, and will be pleased to send a copy to any of our readers.

"*Journal* of the Institution of Electrical Engineers." Vol. LII, No. 227. London: E. & F. N. Spon, Ltd. Price 3s. 6d.—The issue for February contains the following papers:—"Notes on International Standardisation of Electrical Machinery," by A. R. Everest; "Reactance and Reactance Coils in Power Circuits," by E. P. Hollis; "Electric Train-Lighting Systems," by T. Ferguson; "On a Variable Condenser with a Square Law." by W. Duddell; "The Theory of the Three-phase Synchronous Machine," by Dr. T. F. Wall; "Address to the Students' Section," by Dr. C. V. Drysdale.

"Practical Uses of the Wave Meter in Wireless Telegraphy." By J. O. Mauborgne. Price 4s. 2d. net. "Handbook of Electrical Methods." Compiled from the *Electrical World*. Price 12s. 6d. net. "American Electricians' Handbook." Compiled by T. Croft. Price 12s. 6d. net. London: Hill Publishing Co., Ltd.

"Sell's Directory of Registered Telegraphic Addresses." London: Business Dictionaries, Ltd. Price 25s. net.

"Lockwood's Builders' and Contractors' Pocket-Book, 1914." London: Crosby Lockwood & Son. Price 4s.

"Incandescent Electric Lamps and their Application." By D. H. Ogley. London: Longmans, Green & Co. Price 2s. 6d. net.

"*Journal* of the Society of Engineers." Vol. V, No. 1. January, 1914. London: The Society. Price 1s. 3d., post free.

"Charter, By-Laws and List of Members of the Iron and Steel Institute." Corrected to January 1st, 1914. London: The Institute. Price 1s.

"*Bulletin* of the Association des Ingénieurs Electriciens." Vol. XIII, No. 11. November, 1913. Liége: The Association. Price 7 fr. 50.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." Vol. XVI, No. 2. December, 1913. Liége: Lahaye and Co. Price 1 fr.

Messrs. W. & G. Foyle, of 121 and 123, Charing Cross Road, London, W.C., have issued a new edition of their catalogue of technical books.

Catalogues and Lists.—Messrs. H. W. Butler & Co., Craven House, Kingsway, London, W.C.—Two illustrated bulletins (8 pages). One shows electric traction motors, electric locomotives, motor winches, and other manufactures of the Jeumont Electric Plant and Cable Works; the other particularises Jeumont single, two, and three-phase variable speed motors and cables. The firm are sole agents for the Jeumont company.

Messrs Turners & Manville, Ltd., Hopetoun House, Lloyd's Avenue, London, E.C.—Leaflet giving particulars, with illustrations and prices, of "Fiberene" buckets, which are claimed to possess electrical insulating qualities, to be lighter than wood, seamless, unshrinkable and non-absorbent, &c.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Eight-page price list (Section I) of incandescent electric lamps, including various makes of tungsten lamps and carbon lamps for lighting, also radiator, tubular, candle and battery lamps.

Messrs. Krupka & Jacoby, Ltd., 26 to 36, Chapter Street, Westminster, London.—Leaflet (H.C.A.) of four pages, containing illustrations and tabulated prices of electric cookers, warm-plates, kettles and teapots, also electric flat-irons, and water heaters, for the manufacturers of which they are acting as sole agents.

The Curzon Steam Meter Co., 185, Princess Street, Manchester.—12-page booklet (second edition) containing a full descriptive account of the Curnon steam meter, its principle of operation, uses, advantages, &c.

Messrs. A. Seage & Co., Cambridge Switch Works, Hammeramith, London, W.—A number of illustrated and priced leaflets have been issued relating to Home Office bridge fuses, ironclad switches, fuseboards, accumulator and cinematograph switchboards, and knife switches.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—In order to avoid any possibility of their publicity literature getting out of date either in respect of design or price, the company have decided to issue quarterly "Progress" publications which will supplement the bound catalogues already in the hands of the trade and will give particulars of alterations and additions in convenient form. The object is to maintain continuity between the issue of one general catalogue and another. The first copy of "Progress" has just been received, and it brings the complete lists up to date to the beginning of October, 1913; since then other alterations have, of course, been made, and these will be announced in the next issue of the publication. Each notice in the present lists has a reference, printed in red, to the page in the catalogues to which the alteration relates. At the end a complete index is given to the catalogue page number, and the Progress sheet reference where information relating to any particular article may be found.

The Hoffmann Manufacturing Co., Ltd., Chelmsford.—Eight-page circular No. 900, describing very fully their standard roller journal bearing, with sectional illustrations and tabulated sizes, prices and code-words. This short roller bearing is now listed for the first time, although the company have had such bearings running for over four years on heavy power station units.

The A.E.G. Electric Co., Ltd., 133-135, Oxford Street, London, W.—A collection of supply price lists in expanding binding cover detailing a variety of electrical manufactures, including fans, kettles and pots, radiators (luminous and convector types), electric irons, hairdresser's appliances, drawn wire and carbon lamps, carbons, flame arc lamps, boot-cleaners, watertight fittings, electric signs, ½-watt lamps, &c. The lists are in an expanding cover, allowing additions to be made as issued.

Allgemeine Electricitats-Gesellschaft, Berlin.—Leaflets describing small rotary transformers, D.C.-D.C. and A.C.-D.C., for experimental purposes, giving ⅔ and ½ ampere at eight volts, and a universal electric welding machine. Also pamphlet about the lighting of large workshops with flame arc lamps.

Messrs. David Killoch Co., 57, Murray Street, New York City, U.S.A.—Manual of wireless telegraphy and catalogue of electrical supplies and novelties.

Foreign Enterprise in Turkey.—A representative of a Viennese firm, who is an engineer, has recently been making several months' stay in Constantinople, and gives in the *Zeitschrift des Oesterreichischen Ingenieurs und Architechten Vereines* an interesting account of his impressions. Only scanty details find their way into publicity, he says, with regard to public works in the Turkish capital and Empire, and the Austrian Consulate has no engineer attached to its staff; therefore all news thence is more or less of a private nature and frequently unreliable. During his stay in Constantinople he has made it his business to investigate matters and submit comprehensive details, which, however, are not wholly exhaustive. His observations embrace town planning, water supply, sewerage, paving, buildings, bridges, navigation, wharfage, lighting, tramways, railways, telephones and sundry works, also irrigation schemes in Asia Minor. On the subject of lighting arrangements, he states that the present system (gas for Pera, in Dolma Baghtsché, and for Stamboul, in Jedikuli) is inadequate, and will shortly be replaced by electricity, the central station for which, at Silihdar, on the Golden Horn, will shortly be completed. The lighting of Scutari is in the hands of the Société du Gaz Scutari-Kadikeny, whose station is located at Courbali Deré, 3 km. from Kadikeny, but will shortly be shifted to Djadi-Boshan. With regard to tramways, the German Société des Tramways de Constantinople have suspended the horse traction on their lines Galata to Galata Serai and Chichli, Galata to Ortakeny, Emin Eunu to Top Capou, and Ak Serai to Yédi Koulé. The yearly traffic on these lines totalled about 10,000,000 passengers. On the other hand, the conversion of these lines to electric traction is making rapid progress, and before long the service between Pera (Tunnel Station) and Chichli will be opened. At Beschiktasch there is a temporary power station, which will later on be superseded by that of the Société Ottomane d'Electricité de Constantinople. Further, the following lines of the company have been sanctioned:—Ak Serai to Silivri Capou, Emin Eunu to Sirkedédji, Taxim to Dolma Baghtsché, Pancaldi Military School to Matchka, Férikeny to Azap Capou, Emin Eunu to Eyoup, and Ortakeny to Bébek. The constructive works for the Société d'Electricité were carried out by the French firm of Giros et Loucheur, and the erection of the works at Silihdar on the Golden Horn necessitated an expenditure of about 600,000 fr. On the line from Galatz to Ortakeny and Emin Eunu to Top Capou now run motor-cars owned by the Société d'Omnibus et d'Autobus.

With respect to the urban railways, the tunnel line from Galata to Pera has been for a long time worked by "The Metropolitan Railway of Constantinople from Galata to Pera." The traffic yearly is about 4,000,000 passengers. New urban railway schemes are being drafted by the "Chemins de fer Métropolitains de Constantinople et de sa banlieue," which company with others forms a traffic trust. An electric express line between Karakeny (Galata) and Roumèli Fener (Bosporus) is projected by the firm of Lenz & Co., of Berlin, plans and measurements of which have been published in No. 5 of the *Génie Civil Ottoman*, 1912. Ganz et Cie., Société Anonyme d'Eléctricité, of Budapest, also propose the construction of a line from Scutari to Kadikeny. As regards telephones, there is a network 40 kilometres in extent, underground, constructed by the Société Ottomane des Téléphones de

Constantinople. With respect to the railways in the Turkish Empire generally there is little new to add. Their construction is chiefly effected by the Régie Générale des Chemins de Fer et Travaux Publics, under its able head Otto Kapp von Gultstein, who is ever active in surveys and plans for new lines in Armenia, Mesopotamia and Syria. Irrigation schemes in Asia Minor, the construction of docks, &c., are carried out by the firm of John Jackson, Ltd., London, who have a branch in the Place Chichané-Caracol, Galata, and by a French group, Pearson and Son and Fonquiau. Summarising his data, the writer concludes with the statement that in Turkey France takes the leading place with about 3 million francs engaged; Germany is forging rapidly ahead with railways and other constructive works; while England is little concerned to secure new concessions. A quotation from the *Deutsche Levante-Zeitung* is appended, which incidentally reveals the feverish energy and lavish capital which Germany is dispensing in the "development" (*i.e.*, creating new industries and supplying their machinery and other requirements) of all forms of enterprise in Asia Minor.

Liquidations and Dissolutions.—The Stolz Electrophone Co. (London), Ltd.—By an order of January 22nd, Mr. A. F. Whinney, of 4, Fredericks Place, Old Jewry, E.C., was appointed liquidator in the voluntary winding-up of this company in the place of Mr. E. Thorpe.

The Stolz Electrophone Co. (1913), Ltd.—A petition for the winding-up of this company has been presented by Mr. A. Hyman, of 4, Heath Drive, Hampstead, shareholder and creditor, and is to be heard on February 10th, in London.

The Globe Associated Cable and Telegraphic Services, Ltd.—A petition for the winding-up of this company has been presented by various creditors, and is to be heard on February 10th, in London.

The Ebro Light and Power Construction Co., Ltd.—A meeting of creditors is called for February 10th, at Thanet House, 232, Strand, W.C., by the liquidator, Mr. R. H. Bentley. Claims must be sent in by March 12th.

The Mexican Fuel and Power Co., Ltd.—A meeting will be held at Pinner's Hall, Austin Friars, E.C., on March 4th, to hear an account of the winding-up from the liquidator, Mr. R. C. F. Chichester.

J. R. Cleworth & Co, electrical engineers, 77, Pear Street, Halifax, Yorks.—Messrs. J. R. Cleworth and T. W. Howell have dissolved partnership. Mr. Cleworth will attend to debts.

Messrs. Frederick Thompson and Hans Ochsenbein, trading as Thompson & Co. at 15 and 16, Garlick Hill, E.C., as electrical and mechanical engineers and commission agents, have dissolved partnership. Debts will be attended to by Mr. H. Ochsenbein, who will continue trading at the above address under the title of "The General Cable Manufacturing Co.," for electric wires and cables, and "Jeumont Copper Works," for drawn copper wires, commutator segments, &c. Mr. F. Thompson will trade at 48, Watling Street, E.C., as Thompson & Co., being London agent for the Yorkshire Cable Co., Ltd., and British agent for the Rex Meters.

Trade Announcements.—Messrs. Andrews & Co., 198A, St. Vincent Street, Glasgow, have been appointed sole agents for the Gleniffer Motors, Ltd., of Anniesland, Glasgow, for the sale of their petrol and paraffin electric sets.

Messrs. Humphreys-Davies & Co., of 5, Laurence Pountney Lane, Cannon Street, E.C., announce that they have entirely severed their connection with the Machinery Users' Association (Inc.). They have accepted the appointment of surveyors to the Manufacturers' Association, Ltd., which has recently been formed for the purpose of advising users of machinery upon all questions connected with the rating of tenants' machine tools and assessments upon mills and factory property for Imperial and local purposes.

The Resisto-Electrical Manufacturing Co., Ltd., have removed from Walbrook, E.C., to 7, Gracechurch Street, E.C. New telephone No., "Avenue 6427" (2 lines).

Mr. John Richards, electrical engineer, whose head office is at Burton-on-Trent, with branch offices at Leek and Longton, is about to open an office in Macclesfield, at 34, Market Place.

Mr. George Sykes, for six years Yorkshire representative of the Union Electric Co., has severed his connection with this firm, and has taken up a similar position upon the staff of the Phœnix Dynamo Manufacturing Co., Ltd., Thornbury Works, Bradford.

The Midland Electric Manufacturing Co., Ltd., Birmingham, inform us that Mr. G. W. Humphreys has now ceased to represent their interests in South Wales, the agency having been transferred, from the 1st inst., to Mr. C. W. Jordan, 23, St. Mary Street, Cardiff. The company have appointed Mr. C. Pegler, of Abbeydale Road, Northfield, as their representative for the Midland Counties from the 1st inst.

The 150-Watt Mazda Lamp.—The B.T.H. Co. are now listing a new size of Mazda lamp, taking 150 watts at 100-130 and 200-260 volts, to meet the demand for a lamp intermediate in size between the present 100 and 200-watt lamps.

Calendar.—A large wall calendar in metal has been received from Pirelli's, Ltd., of 144, Queen Victoria Street, E.C., with a daily block of slips with large figuring in red. An interesting picture in colour will remind us that Pirelli tires are "sure of a good run."

New Works at Newport.—It is announced that the British Mannesmann Steel Tube Co. will shortly erect at Newport (Mon.) new works to employ 3,000 men. The cost of the buildings and plant is stated to be £750,000.

LIGHTING and POWER NOTES.

Aberdeen.—New Plant Started up.—Members of the T.C. inspected the electricity works last week, when a new 3,000-kw., three-phase, 6,600-volt turbo-alternator was started up. This machine runs at 3,000 r.p.m., and supplements a 1,000-kw. turbo-alternator of the same speed. Three 500-kw. motor-converters have also been installed, to couple the A.C. and D.C. generating plant. Two ½-watt lamps have been installed in the power station.

Tramway Supply.—The Suburban Tramways Co. has agreed to the new arrangements by the T.C. for the supply of electricity, whereby the company is to take a minimum of 140,000 units per annum, at 1½d. per unit, on a five years' agreement from June next.

Accrington.—New Plant.—The Electricity Committee has decided to seek powers to borrow £33,530 for plant and extensions at the electricity works.

The electrical engineer has submitted a provisional tender for additional 2,000-h.p. gas-engine sets and other plant, amounting to £27,030.

The L.G.B. has sanctioned the borrowing by the Council of £2,500 for transformers in connection with the electricity undertaking.

Argentina.—The statutes of the Compania Eléctricidad de Corrientes, the Compania de Alumbrado Eléctrico de Rio Gallegos, and the Compania de Luz é Industrias Electricas have been approved.—*Review of the River Plate.*

Australia.—The agreement between Perth (W.A.) City Council and the W.A. Government, according to *Commonwealth Engineering*, stipulates that the latter shall build a 9,000-kw. (initial capacity) generating station, lay a ring main round Perth with the necessary h.t. switchgear and meters at not exceeding four points of delivery to the Corporation. The Corporation is to purchase all energy from the Government for 50 years, at a price not exceeding ¾d. per unit. The Government is not to supply within a radius of 5 miles from the G.P.O., and the Corporation has the right to supply in bulk to any Municipal Council or Roads Board. The Government supply will be three-phase at 6,000 volts and 40 cycles.

Bacup.—Street Lighting.—The Lighting Committee has decided that, provided satisfactory arrangements can be made with the Electricity Committee, the lighting of the main roads from Britannia to Bacup, and from Bacup to Waterfoot, be converted to electricity.

Barrow.—Street Lighting: ½-watt Lamps.—The T.C. has approved a large number of extensions to mains. It has also agreed to replace nine of the arc lamps in Michaelson Road with ½-watt tungsten filament lamps, placed alternately with the nine remaining arc lamps, so as to afford a comparison, and that, if the new lamps make it possible to improve the lighting without increasing the cost, the replacement of the remainder of the arc lamps should be proceeded with. The three-phase supply of electricity to the Furness locomotive works was reported to have commenced, and the works are now being entirely run by motors supplied from the Corporation mains.

Bawtry.—E.L. Scheme.—The electors have decided to support the E.L. scheme, introduced by Messrs. Best & Pullen, of Bradford.

Belfast.—Proposed New Plant.—The electrical engineer has reported to the Tramways and Electricity Committee that next December the normal load would necessitate the direct-current machinery for both tramway and lighting purposes, with the exception of one of the large units, being in operation simultaneously. As, in the event of one of these being out of commission, there would be no spare plant, he recommended the installation of a 1,000-kw. battery with boosters and switchgear. The matter was referred to a sub-Committee.

Bexley.—The application of the Foots Cray E.S. Co., Ltd., for a supply of electricity has been held over by the U.D.C., pending a settlement on the question of the extension of its plant.

Bispham.—The U.D.C. is objecting to the B. of T. against the granting of a prov. order for electric light to the Thornton Council.

Bradford.—An interesting point which is being tested in this city is the proposition that worsted yarn spinning by electrical power produces more even quality than is obtained by steam power. The electrical installations so far in the wool textile area hereabouts are mainly in the weaving sheds.

Bradford-on-Avon.—The clerk has reported to the R.D.C. that through a misunderstanding, notice of objection against the application by a company for a prov. order for E.L. had been filed, but when the agreement was filed, the Council's opposition would be withdrawn.

Braunton (Devon).—Proposed E.L.—An E.L. scheme for the village of Krowle, brought forward by Mr. J. Dennis, has been referred to the Lighting Committee, after favourable discussion by the P.C.

Brentford.—Workhouse Lighting.—The Engineering and Works Committee has instructed Mr. W. H. Massey to report as to the advisability of adopting E.L. at the Union buildings.

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Bridlington.—The Electricity Committee has passed the following charges for electricity for heating and cooking purposes:—Up to 100 units per quarter, 2d. per unit; above 100 units per quarter, 1d. per unit.

Bristol.—SCHOOL LIGHTING.—The Education Committee has decided, as each school needs re-decorating, to consider the question of having E.L. installed in place of gas.

Canada.—The estimated expenditure for 1914 at Edmonton includes $500,000 for extensions at the electricity works. A new power house, to contain one or two units, will probably be built. The estimated expenditure on the street railway system is $50,000.—*Canadian Electrical News.*

Chester-le-Street.—The Joint Hospital Board has decided to use electric power for the machinery and ironing at the laundry. The present machinery is to be adapted for the purpose.

Chiswick.—THE E.L. PURCHASE SCHEME.—The poll taken last week on the scheme for acquiring the undertaking of the Chiswick Electricity Supply Corporation resulted in a majority of 534 against proceeding with the Bill. Out of 8,000 electors, only 1,366 voted.

Colne.—The electrical engineer has reported that on account of the demand upon the Keighley Road cable, it was becoming necessary to proceed with the erection of a H.T. sub-station at Cotton Tree, but in the meantime it was essential to install a self-regulating booster at an estimated cost of £200. The matter was referred to a sub-committee.

Continental Notes.—HOLLAND.—According to a return lately issued by the Koninklyl Instituut van Ingenieurs, there were 77 electric supply stations in Holland at the end of 1912, either completed or in course of construction, intended to supply current to 139 towns and villages. Particulars of only 52 were secured, 23 being owned by local authorities, and 29 by private companies. Steam forms the motive power in 33 of the stations, in 13 internal combustion engines are employed, while at six a combination of the two is in use. The total capacity of the 52 stations is 77,861 KW.

RUSSIA.—The municipal authorities of Kieff have decided to acquire the electric lighting and tramway undertakings in the town from the concessionaires.

Among loans recently authorised, according to the *Board of Trade Journal*, are £116,400 for electric tramways, and £50,800 for electric supply extensions at Perm.

GERMANY.—On February 1st the new municipal power station at Spandau was started up, the bulk supply from the Berliner Elektricitäʻswerke was discontinued, and the tariff was reduced 15 per cent. The Corporation is promoting a joint scheme in conjunction with neighbouring authorities.

The Prussian Minister for Railways has announced that, owing to recent improvements in electric train-lighting systems, all sleeping cars will in future be lighted by this means. Some of the ordinary coaches have already been equipped with electric lighting.

ROUMANIA.—We hear that Messrs. Stone, of Dartford, are at present engaged in equipping a number of trains with their system of electric lighting for the Roumanian State Railway authorities.

Criccieth.—PROPOSED E.L.—The U.D.C. has decided to negotiate with the North Wales Power Co. for the supply of electricity. The Committee was authorised to consult an expert.

Deal.—The T.C. has decided to oppose the Deal and Walmer Gas and Electricity Bill. The Mayor said the Council would probably be able to obtain electricity in bulk from the colliery generating station at Tilmanstone, and ultimately from Snowdown, and distribute it on far more favourable terms than those proposed in the Gas Co.'s Bill.

Dover.—PUBLIC LIGHTING.—The T.C. has appointed a Sub-Committee to go into the matter of public lighting, and to consider the question of utilising electricity instead of gas. The agreement with the Gas Co. expires on March 31st next.

Dublin.—ANNUAL REPORT.—The report of the Electricity Supply Committee shows that the net profits for the past financial year amounted to £7,767, compared with £11,670 in the previous year. The reduction is attributed to dearer coal and the effect of the Shop Hours Act. There was an increase of approximately 840,000 units sold. The coal consumed cost £17,483, as against £11,839 in the previous year. The Committee is strongly opposed to taking off the 10 per cent. added to the charges for energy three years ago, pointing out that the working expenditure is becoming greater each year, and the Council must face the provision of a reserve.

The Corporation has decided to oppose the Alliance and Dublin Consumers' Gas Co.'s Electric Supply Bill. The Bill authorises the company to supply electricity in Blackrock, Kingstown and Dalkey. The town clerk pointed out that if the Bill was passed in its present form, it might be taken as a Parliamentary declaration that the Gas Co. had power to supply electricity in all the gas areas, including the City of Dublin, and thus compete with the Corporation. Resolutions to oppose the Bill were also adopted by the Blackrock and Kingstown U.D.C.'s. The law agent of the former body pointed out that if the Bill passed in its present form, the company would be in a position to charge 8d. a unit for electricity. The Bill also provided for overhead mains and wires, while in the agreement between the Council and the Gas Co., overhead wires were only to be allowed in certain places.

Dundalk.—The first 10 months' working of the E.L. undertaking showed a deficit of £162; it is estimated that the undertaking will show a profit this year, and it will shortly be necessary to extend the power station to meet the demands.

Eastbourne.—PLANT EXTENSIONS.—Reporting on the recent breakdown of two high-pressure feeders, the electrical engineer states that it will be necessary to lay one or two new high-pressure feeders from the works to the town, to construct two new sub-stations, and to enlarge six underground sub-stations; alter and add to the high and low-pressure switchgear in four or five existing sub-stations; extend the switchboard at the works; lay a new feeder to duplicate the supply to Willingdon and Hampden Park; and to provide additional fuse boxes and distributor cables in the shop district.

Elgin.—PROPOSED E.L.—At its next meeting the T.C. is to consider a motion as to the introduction of an E.L. scheme.

Ellesmere Port.—PROPOSED E.L.—The D.C. is considering an offer by Mr. E. P. Jones to supply electricity in bulk. Mr. Jones stated that he could supply current at about 1d. per unit, and the Council could retail it at 3d. or 4d. per unit. Inquiries have been made as to the probable demand for current, and the result is thought to be very satisfactory.

Haslingden.—PROPOSED LOANS.—The T.C. has decided to apply to the L.G.B. for sanction to borrow £7,200, made up as follows:—Mains, £3,700; services, £1,500; transformers, switchgear, &c., £2,000. The whole of the money is not to be spent at once.

Hebden Bridge.—On Saturday last a new 330-H.P. Diesel engine set at the Council's generating station was formally started up.

Hemsworth.—The R.D.C. has rejected an E.L. scheme submitted by Mr. T. Charlton, of South Elmsall, on the ground that a monopoly for seven years was stipulated for.

Holmer.—The B. of T. has informed the Hereford R.D.C. that the conditions attached to its consent to the Hereford T.C. supplying electricity to Holmer, cannot be regarded as reasonable, and the Board proposed to grant the Corporation's request. The conditions were that the Corporation would undertake not to have the parish incorporated in the city.

Holmfirth.—L.G.B. INQUIRY.—The application of the D.C. for powers to borrow £7,500 for the provision of plant, and for approval to the appropriation of a portion of the market ground as a site for an electricity generating station, was inquired into by Mr. M. K. North on Tuesday, last week. A prov. order was obtained in 1912, and there was strenuous opposition by objecting ratepayers and the local gas company. Mr. Paddon, on behalf of objecting ratepayers, stated that the requirements of the law had not been observed in regard to the serving of notices on the owners of property adjoining the site for the generating station. He urged that the scheme only provided for a portion of the Council's area, and rather than go in for an electricity undertaking, it was the duty of the Council to utilise modern gas appliances for the improvement of the public lighting.

Ilford.—LOAN SANCTION.—The U.D.C. has received sanction from the L.G.B. to a loan of £21,598 for the provision of a refuse destructor.

Knaresborough.—E.L. SCHEME.—The D.C. has referred the E.L. scheme, which proposes the utilisation of the river Nidd to generate power, to a Committee for consideration.

Leigh.—Messrs. Courtauld & Co., the well-known silk manufacturers, are to build a new mill adjoining their present one, in which the 300 looms will be electrically driven. Two weaving and two cotton mills are also being erected, and are expected to favour the electric drive.

Leyland.—The U.D.C. has decided to oppose the Gas and Electricity Bill being promoted by the Leyland Gas Co.

Limerick.—The Corporation has referred to the E.L. Committee a letter from the L.G.B. stating that the latter cannot sanction a loan of £1,576 to meet a deficit on the working of the E.L. undertaking.

Liverpool.—ANNUAL ACCOUNTS.—The income of the electric supply department on revenue account for the past year was £306,653, and the balance carried to net revenue account after providing for working and management expenses was £171,338. The estimated expenditure this year on capital account is £76,519, on reserve and renewal account £132,534, and on revenue account and interest and sinking fund £289,557.

Lytham.—A special meeting of the T.C. was held last week in opposition to the clause in the St. Anne's T.C. Improvement Bill, wherein the St. Anne's authorities ask for an extension from 1917 of its agreement with the Blackpool, Lytham and St. Anne's Tramways Co., for the running of the cars over the Lytham, as well as the St. Anne's areas. It was stated that St. Anne's was seeking to upset powers gained from the B. of T. after a three days' inquiry. The resolutions were carried.

London.—Bermondsey.—The B.C. is to petition against the Brighton Railway Bill. It is considered that it is open to serious objection, as none of the E.L. companies should be permitted to enter into agreements beyond the date when their undertakings are liable to be purchased.

Southwark.—The B.C. has decided to oppose the London Electric Supply Bill.

Fulham.—The B.C. has approved the resolutions passed at the recent conference of municipal authorities owning electricity undertakings with regard to the proposals of the L.C.C. to further reduce the periods for the repayment of loans for electricity purposes.

Hammersmith.—The Electricity Committee has recommended the B.C. to lay a new cable to Hammersmith Road, at an estimated cost of £1,500.

St. Pancras.—The B.C. is engaged in a discussion with the L.C.C. in regard to the period of repayments to be allowed on certain items in a loan of £9,843 for electricity purposes, applied for last October. The Council is advised to oppose the London Electric Supply Bill, and has decided to support the conference of municipal authorities dealing with the question of a bulk supply scheme.

Manchester.—Year's Output.—The total number of units generated at the Corporation's stations during 1913 was 136,820,180.

Merthyr Tydfil.—On the advice of the architect, the B. of G. has decided to have E.L. installed at Aberdare Industrial School; the estimated total cost is £490. Current will be taken from the Aberdare Council at power rates, and it is estimated that by installing a motor-generator the Board will save about about 1¾d. per unit, against the cost of taking current from the Aberdare mains at lighting rates.

The T.C. has consented to the application for a prov. order extending the period for the compulsory purchase of the electricity undertaking for a further period of 10 years.

Oldcastle (Co. Meath).—Mr. L. J. Lawless, of Rathmines (Dublin), has been appointed consulting engineer in connection with the proposed E.L. scheme.

Reigate.—Electrical Exhibition.—The T.C. has decided to hold an exhibition of electrical appliances at the works on February 16th and following days.

Rochdale.—Two private companies have been registered during the last few days under the style of Tyre Yarns, Ltd., and Fabric Weavers, Ltd., and two new mills at Sudden and Castleton are to be erected forthwith. Each mill will occupy about 14,500 sq. yards. The new mills are to be run and lighted by electricity, and preliminary negotiations have been opened with the Rochdale Corporation for the supply of current. With the existing plant at Rochdale it would be impossible for the T.C. to do this, but when the extensions now in progress are completed, it will be in a position to cope with the large extra demand: land has, however, been leased to permit of a private generating station being provided if necessary.

Salford.—The Electricity Committee has adopted a report of the Works Sub-Committee, in which it is stated that, as the tests on certain turbo-generators show that they have failed to comply with the guaranteed efficiency relative to steam consumption, as provided in the contract, the whole of the plant should be rejected.

The Council is being recommended to amend the charges for lighting purposes, by abolishing, as from April 1st next, the existing concession, whereby users of current for power purposes are allowed to use current for lighting at the power rate up to 10 per cent. per quarter of their power consumption.

Stevenage.—The U.D.C. has decided not to oppose the N. Metropolitan E.P.S. Bill.

Sunderland.—Year's Estimates.—The estimates for the Corporation's electricity undertaking show that the year's revenue to March next will be £73,599, an increase of £4,055 as compared with the previous year. The working expenses are estimated at £35,132, and interest on, and redemption of, loans will absorb about £28,196. The estimated balance of £10,270 will be placed to the reserve and renewals fund, an increase of £1,836 on last year. The estimated output is 14,921,684 units, as against 13,592,621 units during 1912-13. The Electricity Committee suggests that the charge for incandescent street lamps should be reduced from 49s. to 46s. per lamp per annum, the same charge as is made by the gas company.

Tasmania.—The Hydro-Electric Power and Metallurgical Co. has been granted an extension of time to July 31th, 1915, in which to complete the works now under construction.

Taunton.—L.G.B. Inquiry.—An inquiry was held last week by Mr. A. G. Drury into the application of the T.C. to borrow £4,950 for extensions to the electricity undertaking. There was no opposition.

Uruguay.—The Board of Administration of the State electric power stations, has decided to undertake the works necessary for the supply of electric light and power to the districts of Colon, La Paz, and Las Piedras. It is expected that these services will be in operation within six months.—*Review of the River Plate.*

Venezuela.—Following the example of Caracas and Valencia, electric lighting is about to be introduced into several other towns in Venezuela. Among the places where concessions have lately been granted are Barcelona, Los Teques, and Ocumare.

Warrington.—The British Engine, Boiler and Electrical Insurance Co. is to be requested to prepare a specification for an electrical stoking installation at the Corporation gasworks.

West Yorks.—E.L. Proposals.—At its last meeting the Goole R.D.C. decided to support the application of the Yorkshire Electric Power Co., for powers to supply electricity for lighting purposes within its area; the Guiseley D.C. has resolved, before anything definite is settled, to arrange for a representative of the company to attend at its next meeting; the Halifax T.C. has resolved that the Mayor and the chairmen of the Finance and Tramways and Electricity Committees be instructed to take steps with a view to protecting the rights of the Corporation and giving it power to lodge a petition against the Bill; and the Gunthwaite and Ingbirchworth Council have decided to support the application.

The Leeds Corporation Parliamentary Committee has decided to present a petition against the Power Co.'s Bill, and the town clerk has been instructed to arrange a meeting of local authorities affected by the proposals.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. System.—The Tramways Committee has agreed to adapt four tramcars on the Mannofield route, and the cars on the Beach and Terry routes, to the P.A.Y.E. system.

Accrington.—The T.C. is to be recommended to apply to the L.G.B. for power to borrow £9,000 for extensions at the tramways depôt.

The three Corporations of Accrington, Rawtenstall and Haslingden, working the through tramway service between Accrington and Bacup, are in difficulty. They decided to accelerate the service to one of 10 minutes, but it was found, as compared with the former service, there was a great leakage in profits, amounting, in the case of Haslingden, to some hundreds of pounds. Haslingden was wishful, and Accrington willing, to revert to the 15 minutes' service, but Rawtenstall suggested if this were persisted in it might withdraw from the through running agreement. Rawtenstall, however, is influenced by the fact that the Lancashire and Yorkshire Railway Co. is competing with it by running a motor-rail service between Rawtenstall and Bacup.

Australia.—The returns of the Adelaide Municipal Tramways Trust for the year ended July 31st last show that 41,576,483 passengers were carried and 5,140,706 car-miles run. The total revenue was £309,642. The capital expenditure now stands at £1,350,710.—*Commonwealth Engineer.*

The annual report of the N.S.W. Tramways shows that the revenue was £492,830, an increase of £41,840 as compared with the previous year, and the expenditure £445,476, an increase of £37,817. Some 81 million passengers, an increase of 6 millions, were carried.

Barking.—The U.D.C. has accepted the terms of the Ilford U.D.C. for leasing the tramways from Loxford Bridge to Broadway.

Bingley.—New Tramways.—The extension of the Bradford Corporation electric tramways from the Nab Wood terminus to Bingley was formally opened on Tuesday. The extension is not quite complete. The remaining portion, from Bingley to Cross Flatts, towards Keighley, has had to be delayed in construction by difficulties in regard to road widening.

Bradford.—Railless Traction.—The Tramways Committee has decided to proceed with the equipment of railless traction systems on the following routes:—Odsal to Oakenshaw; Bankfoot to Dudley Hill; Laisterdyke to the "Junction," Bolton; Peel Park to Little Horton, and Forster Square to Bolton Woods, *via* Canal Road.

Burnley.—The Tramways Committee has decided to recommend the Council to authorise the carrying out of alterations at the car-shed at an estimated cost of £3,100.

Canada.—The Barrie (Ont.) Council has been authorised to construct an electric railway between Barrie and Midhurst.—*Canadian Electrical News.*

Continental Notes.—Norway.—An electric railway has been projected for some years between Trondhjem and Yonsvandet, and a survey of the route is now being made, probably with a view to its construction at an early date.

Sweden-Denmark.—It is reported from Stockholm that two Danish engineers have submitted to the Swedish and the Danish Governments a simultaneous application for a concession to construct a railway tunnel under the Sound between Zeeland and South Sweden. According to the plans, the tunnel would start from the island of Amager, outside Copenhagen, and run to the central railway station at Malmö, *via* the small island in the

Sound, the Saltholmen. The railway would be worked by electricity, and would be single track, except at the island, where a passing place would be provided. The estimated cost is five million pounds.

BAVARIA.—A concession has been granted for the construction and operation of an electric rack railway to the summit of the Zugspitze (2,963 metres above sea level), the highest mountain in Germany.

Dublin.—An agreement was arrived at in the Recorder's Court, Dublin, on Friday, fixing the valuation of the Dublin United Tramways Co. at £41,000, for three years from January 1st, 1914.

Twenty persons were injured last Sunday owing to the capsizing of a tramcar.

East London Railway.—Speaking at the annual meeting of this company, Lord Claud Hamilton reviewed the seven months' working by electricity, pointing out that the expenditure, on converting the line, had amounted to £82,000; the average increase in monthly revenue during the period had been £440, but the November receipts were up £616, as compared with November, 1912. The number of passengers carried for the year ending October 31st was 4,869,000, as compared with 4,261,000 for the previous year.

Edinburgh.—PETROL-ELECTRIC 'BUSES.—After experimenting with various types of motor-'bus, the Tramways Committee has decided to recommend that single-decked 'buses be adopted, and to place orders for three petrol and three petrol-electric Tilling-Stevens 'buses.

Hull.—PROPOSED LOANS.—The Corporation Tramways Committee proposes to apply to the B. of T. for a loan of £17,000, half the total cost, for the establishment of workshops and the necessary plant. The question of finding the balance is referred to the Finance Committee.

Indian Railway Electrification.—The probable cost of the electrification schemes in the Bombay area is put at £781,000, and it is estimated that electrification will bring about 9 per cent. additional traffic, worth £70,000 a year. Running expenses are estimated to show an annual saving of £5,158. An overhead trolley system is preferred, on account of the habit of the natives of walking on the tracks. The lines concerned are the Bombay, Baroda, Great Indian Peninsula and Port Trust Railways.

Ipswich.—ELECTRIC VEHICLES. — For the past six months the electric supply department has been working up interest in the electric vehicle; this campaign was brought to a climax by a demonstration of a ½-ton Edison delivery van and a two-seater Edison run-about, which, by arrangement with the department, Messrs. Edison Accumulators, Ltd., sent down for the purpose. The amount of interest aroused exceeded the most sanguine anticipations of the department, and it is hoped that some of the firms that have been impressed will shortly become purchasers.

Kingston.—The town clerk has been instructed, in connection with the portion of the L.U.T. Co.'s Bill relating to the running of trailers, to ascertain whether the company would be prepared to include a clause excepting the borough from the operation of this section, as the Council is of opinion that they would be dangerous.

Liverpool.—ANNUAL ACCOUNTS.—The Corporation tramway accounts for the past year show that the total revenue amounted to £690,899, traffic expenses absorbed £180,226, general expenses £61,361, and general repairs £121,185, leaving a net revenue of £244,101, which was increased by other items to £268,322. This sum was dealt with principally as follows:—Interest, £48,971; rent of leased lines, £4,869; sinking fund contributions, £60,310; contribution in aid of general rate, £100,000; and reserve, renewal and depreciation account, £54,163. The estimated expenditure on revenue account for the current year totals £598,752, being £54,973 in respect of interest, £63,779 in sinking fund, and £480,000 working expenses; on capital account £57,453, and on reserve, renewal and depreciation account £140,500.

Application is to be made to the B. of T. for sanction to borrow £18,000 for the provision of additional tramway cars.

Middlesbrough.—Last week the Imperial Tramway Co. introduced a service of motor-'buses in connection with the tramway service between the Royal Exchange and Grove Hill.

Midland Railway Electrification.—According to the *People* the Midland Railway has decided to electrify its lines from St. Pancras to Hendon.

Nelson.—RAILLESS TRACTION.—The Tramways Committee has decided to recommend the Council to adopt a railless traction scheme for the Walverden and Southfield districts.

Northampton.—The Tramways Committee has recommended the Corporation to refuse the offer of the Northampton E.L. and P. Co. to supply electricity for tramway purposes at ¾d. per unit for a specified term of years, or to accept £350 for a stand-by of 200 KW., and energy as might be required at ¾d. per unit.

Reading.—RAILLESS TRACTION.—A poll of the ratepayers has sanctioned the extension of the tramways to the annexed portions of the borough, and the provision of supplementary services of railless trolley-cars and motor-'buses to Caversham and Tilehurst.

Sunderland.—ESTIMATES.—The estimates approved by the Tramways Committee for the year ending March next put the total income at £74,864, as against £68,871 in 1912-13, and the net profit at £14,394, as compared with £11,293. The working expenses were estimated at £42,622, leaving a gross profit of £32,242. For the payment of interest on loans £6,837 is appropriated, and for repayment of loans £9,948. It is proposed to give £5,000 to the relief of the rates, and to allocate £9,394 to the reserve and renewals fund.

Uruguay.—It is reported that after lengthy negotiations, the Government is now disposed to sanction the electrification of the Tranvia del Norte, which in 14 years reverts to the State.—*Review of the River Plate.*

U.S.A.—A census lately taken of the users of electrical motor vehicles in New York shows that such machines are being employed in no fewer than 74 different trades. Brewers head the list with 19 firms and 322 vehicles, departmental stores following with 17 and 262 respectively, parcels delivery companies with 7 and 197, bakers with 8 and 154, and central electricity stations with 2 and 127.

It has been decided to electrify 113 miles of main line in the Rocky Mountains, on the Chicago, Milwaukee and Paget Sound Railway. The line will be operated on the 2,400-volt direct-current system, with overhead trolley construction; current at 100,000 volts A.C. will be transmitted to five sub-stations of from 3,000 to 4,500 KW. capacity. The electrification will correspond to that adopted by the Butte, Anaconda and Pacific Railway.

TELEGRAPH and TELEPHONE NOTES.

German Colonies.—It was recently found practicable to communicate between the Nauen station, near Berlin, and Togoland, and it is now stated that the German Imperial Post-Office authorities have granted a concession to the Telefunken Co. to work a wireless connection between Germany and the African Colonies. The connection is conceived in the sense that messages are first to be sent from Nauen to Atakpame station, Togoland; then forwarded to the Duala station in the Cameroons, and thence to Windhuk, in South-West Africa, whilst the traffic to Tabora station in East Africa is to be dealt with through the intermediary of the station in the Cameroons. It is said that these arrangements will render it possible for telegraphic communication with the German protectorates to be effected independently of foreign companies in the future. It is expected that the service between Nauen, Atakpame and Windhuk will be opened for public use in the second half of the present year, whilst the construction of the Tabora station in East Africa is to take place next year. The shares of the Telefunken Co. are in the possession of the A.E.G. and the Siemens & Halske Co.

Manchester and Liverpool.—Arrangements came into force on February 1st, according to which telephone subscribers in Manchester and Liverpool are enabled to obtain speedy connection without the formalities attending a "trunk" call, the two areas being in fact treated as one.

High-Speed Telegraphy.—The Postmaster-General has appointed a Committee to inquire into systems of high-speed telegraphy and to report thereon. The Committee will consist of Captain Norton, M.P., Sir John Gavey, Mr. John Lee, Mr. W. M. Mordey, Mr. A. M. Ogilvie, Mr. W. Slingo, and Mr. A. B. Walkley. Anyone desirous of giving evidence before the Committee should communicate with Mr. G. O. Wood, Secretary's Office, General Post Office, who has been appointed secretary to the Committee.

Wireless in Surveying.—An important frontier survey under the command of a British officer has been completed in Bolivia with the aid of wireless telegraphy, which was used to receive time signals from Porto Vallo, 120 miles from the base of operations. By this means it was possible to fix longitudes accurately without depending upon chronometers.

Wireless on Board Ship.—During the second half of 1913 the Marconi International Marine Communication Co. equipped an average of one fresh ship per day with wireless apparatus, thereby bringing the total number of vessels so far handled up to approximately 1,800 at the end of 1913, this figure being exclusive of warships.—*Financial Times.*

Some new steamers built on the Clyde have been fitted with installations of the Siemens "quenched-spark" system of wireless telegraphy. The guaranteed ranges are 200 miles by day and 330 miles by night.

Brazil.—A decree has been granted authorising Senor Américo Demaria to establish a public telephone service in Posadas, Santa Ana, San Ignacio, Apostoles, Concepcion, and adjoining towns. The term of the concession is for 30 years.—*Review of the River Plate.*

New Cable.—A new four-wire cable has been laid between Germany and England for telegraphic purposes, from Mundesley, in Norfolk, to Emden. The cable is 274·287 nautical miles in length, and has a total weight of 180 lb. copper per nautical mile. The gutta-percha covering is 150 lb. to the nautical mile.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY (NEW SOUTH WALES).—March 18th. For the Postmaster-General. Seven automatic switchboards. Schedule No. 179. See "Official Notices" to-day.

March 2nd. Sydney Harbour Trust. Circular Quay. Three electrically-operated semi-portal travelling cranes for Berths Nos. 1, 2 and 3, Woolloomooloo Bay. Particulars from Engineer-in-Chief of the Trust.

March 25th. N.S.W. Railways and Tramways Department.—Five 1,000-KW. sub-station units to specification No. 124. Particulars at Electrical Engineer's Office, 61, Hunter Street, Sydney.—*Tenders.*

ADELAIDE.—February 11th. P.M.G. 50 cable terminals. See "Official Notices" January 9th.

MELBOURNE.—February 17th. P.M.G. Cable boxes. See "Official Notices" January 9th.

February 18th. 1,590 opalescent arc lamp globes for City Council. See "Official Notices" January 23rd.

April 7th. P.M.G. Accumulator batteries (Tudor) for radio-telegraph stations. Relays, non-polarised, Stores Schedule 996. See "Official Notices" to-day.

MELBOURNE.—March 5th. 20,000-volt and 1,500-volt underground cables and accessories, for Agent-General for Victoria. See "Official Notices" to-day.

HOBART.—March 2nd. For the Postmaster-General. Telephones, common battery, wall pattern, and table pattern, Schedule T 104. See "Official Notices" January 16th.

Austria. — VIENNA. — February 20th. The K.k. Direktion für die Linien der Staatseisenbahn Gesellschaft invite tenders for the supply of an electric locomotive sliding platform for the Simmering Railway workshops. Plans, &c., from Abteilung IV/6, Zugförderung und Werkstattendienst, 3 Schwarzenbergplatz, Vienna I.

February 15th. Austrian State railway authorities, Pilsen. A number of electric motors for the new railway tender repairing shop.

Ballyconnell (Co. Cavan).—February 14th. Horizontal gas engine and suction plant; 18-KW. dynamo and motor dynamo; storage battery and accessories; switchboard and connections; overhead mains and street lamps, for Ballyconnell Electric Light and Power Co. See "Official Notices" January 30th.

Belfast.—February 23rd. Corporation. 12 months' supply of stores for Tramways and Electricity Committee. See "Official Notices" January 30th.

Belgium.—February 8th. La Société du Canal et des Installations Maritimes, of Brussels (59, Rue du Canal) are inviting tenders for the supply of three 2-ton electrically-operated cranes.

Birkenhead.—February 24th. Corporation. Continuous-current electricity meters (ordinary and pre-payment). House service fuseboxes. See "Official Notices" to-day.

Birmingham.—February 11th. Electrical stores for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

Blackburn.—February 14th. Corporation. Twelve months' supply of stores for Electricity Department. Specification (deposit 3s. per section) from Mr. P. P. Wheelwright, Corporation Electricity Works. See "Official Notices" January 30th.

Blackpool.—February 18th. The Tramways Committee invites tenders for uniform clothing for the traffic staff for twelve months. Particulars from Traffic Superintendent's Office, Blundell Street Depôt.

Bolton.—February 23rd. Corporation. Twelve months' supply of tramway stores. See "Official Notices" to-day.

Bradford.—February 19th. Corporation. Cooling towers and induced draught plant. See "Official Notices" January 30th.

Bristol.—Docks Committee. One 2-ton electrically-driven overhead travelling crane. Specifications, W. W. Squire, Engineer's Office, Cumberland Road, after depositing £1 (returnable) with the Secretary, Queen Square.

February 12th. Corporation. 12 months' supply of electrical stores. See "Official Notices" January 30th.

Colchester.—February 7th. Electrical fittings for lighting, electrical equipment for cars, overhead equipment, car fittings, &c., for the T.C., for a year. Mr. R. C. Bullough, General Manager and Engineer of the Tramways, Magdalen Street.

Copenhagen.—February 21st. Municipality. Three 300-KW. motor generators or converters for sub-stations; also switchgear. See "Official Notices" to day.

Croydon.—February 16th. Corporation. 12 months' supply of stores for electricity department. See "Official Notices" January 30th

Greenock.—February 11th. The time for receiving tenders for the new 150-ton electric crane to be erected at the James Watt Dock, Greenock, expires on 11th inst.

Grimsby.—February 12th. Coal (fine slack from hard steam coal) for nine months, for the Corporation Electricity Works. Mr. W. A. Vignoles, Borough Electrical Engineer.

Halifax.—February 16th. Corporation. Stores and materials for the electricity department. See "Official Notices" January 23rd.

February 16th.—Stores for Tramways Department for a year. The Tramways Engineer, Tramways Office, Skircoat Road.

Hornsey.—February 24th. Corporation. Electricity meters, cables, cable stores, &c. See "Official Notices" Jan. 30th.

Ipswich.—February 17th and February 21st. Corporation. Paper-insulated cables for C.C. and A.C. three-phase systems. Fused mains disconnecting boxes and service boxes. See "Official Notices" to-day.

Keighley.—February 7th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. Mr. J. N. Clarkson, clerk, North Street, Keighley.

Leeds.—February 16th. City Tramways. Supply of materials including electrical sundries. J. B. Hamilton, Manager, City Square.

February 21st. Corporation. Twelve months' supply of coal and other stores, including a number of electrical items. See "Official Notices" January 23rd.

Liverpool.—February 12th. Corporation. About 100 standard traction 40-H.P. double-motor equipments. Mr. C. W. Mallins, General Manager, Corporation tramways.

London. — L.C.C. — February 17th. Installation at County Secondary School, Hilly Fields, Brockley, S.E. (223 points, 312 lights). See "Official Notices" January 30th.

ST. MARYLEBONE.—February 11th. Corporation. Underground cables, house cables, flexible cords, rubber goods, box compound and insulating materials, &c. See "Official Notices" January 9th.

ISLINGTON.—February 25th. Natural draught cooling tower and pipework for Lighting Committee. See "Official Notices" Jan. 30th.

ST. PANCRAS.—March 2nd. Corporation. Supply of arc lamp carbons. See "Official Notices" to-day.

FULHAM.—February 18th. Corporation. Twelve months' supply of electrical stores. See "Official Notices" to-day.

SHOREDITCH.—March 3rd. Corporation. Extra-high-tension and low-tension switchgear. See "Official Notices" to-day.

Madrid.—The Commission de la voie ferrée de Triano invite, in the *Gaceta de Subastas*, tenders for the supply of 2,100 metres of 20 mm. diameter cables for electric tramways.

Manchester.—February 10th. The Electricity Committee invites tenders for the supply, delivery and erection of one 7½-ton overhead hand-power travelling crane, operated from floor level, and gantries. Forms, &c. (one guinea, returnable), Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall, Manchester.

February 17th. Corporation. 12 months' supply of stores for Tramways Committee. See "Official Notices" January 30th.

Newport.—February 16th. Corporation. 12 months' supply of stores, for electricity and tramways department. See "Official Notices" January 30th.

New Zealand.—March 26th. The Dominion Portland Cement Co., Ltd.—Hydro-electric plant, Wairua Falls.—Section 1: Hydraulic equipment, including turbines (1,500 H.P. each), governors, penstocks, valves, &c. Section 2: Generators (1,000 KW. each), exciters, automatic regulators, &c. See "Official Notices" to-day.

AUCKLAND.—April 21st. The Harbour Board. 1-ton and 2-ton truck cranes. Specifications from London agents, W. and A. McArthur & Co., 18, Silk Street, Cripplegate, London, E.C.

Nuneaton.—February 21st. Corporation. One 600-KW. high-pressure, geared, direct-current turbo-generator, surface-condensing plant, pipework, &c. See "Official Notices" to-day.

Portsmouth.—February 17th. Corporation. Twelve months' supply of stores for the Tramways Committee. See "Official Notices" January 30th.

Pontypridd.—February 9th. Corporation. Stores and materials for the electric light and tramway department. See "Official Notices" January 23rd.

Portuguese West Africa.—H.M. Consul at Loanda reports that the electric lighting concession for Loanda has been granted to a Portuguese firm which is in touch with German houses. Although this firm will probably obtain the electrical fittings from Germany, H M. Consul understands that it might be worth while for United Kingdom makers of electrical plant and machinery to get into communication with the concessionaire. It is estimated that the undertaking will require a capital of £50,000, part of which still remains to be found. The name and address of the concessionaire may be obtained on application to the Commercial Intelligence Branch of the Board of Trade in London.—*Board of Trade Journal.*

Redditch.—February 24th. Urban District Council. 6,000 tons coal. See "Official Notices" to-day.

Rhondda.—February 17th. U.D.C. Consumers' electric supply meters for the Gas and Water Committee. See "Official Notices" January 30th.

Russia.—May. According to an advertisement in the *Times*, the Municipal Council of Marioupol invites tenders for the erection and running of an electric tramway in the town (Gouvernement d'Ekaterinoslaw, Russie). Communications, stating terms of contract, to be sent to the Administration Municipale de Marioupol, who will give all necessary information.

Salford.—February 16th. The Tramways Committee invites tenders for two years' supply of uniform clothing. Particulars (stamped envelope), General Manager.

March 4th. Corporation. Stores for the Electricity Department. Main traction switchboard. See "Official Notices" to-day.

Spain.—Tenders have just been invited by the municipal authorities of Orgoz (province of Toledo) for the concession for the electric lighting of the town during a period of 13 years.

February 13th. The municipal authorities of Puebla de Alcocer (Province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of four years.

Turkey in Asia.—March 14th. Forty years' electric lighting concession for Trebizond municipality. Population 50,000 to 60,000; 12 miles of street lighting. Houses mostly occupied by poorer classes. Water power (Deirmen River) available. An English translation of the conditions may be seen at the Board of Trade Commercial Intelligence Department in London.

Walthamstow.—February 25th. Corporation. Stores for electricity supply works and tramways. See "Official Notices" to-day.

West Ham.—February 6th. Corporation. Stores for the electricity department. See "Official Notices" January 23rd.

CLOSED.

Australia. — LAUNCESTON. — City Council. Sub-station equipment :—

Transformers and regulators, £2,061; H.T. switchboard, £1,423.—Australian G.E. Co., Ltd.
Underground feeder cable and joint boxes, £360.—Australian Metal Co.
Tenders.

BRISBANE.—6,000 dry cells, £825. — Brisbane Electrical Co. *Australasian Record.*

Belgium.—Eight concerns, six Belgian and two German, submitted tenders last week to the municipal authorities of Antwerp for the supply of six electrically-operated 5-ton cranes, the lowest offer being that of the Société Liegeoise pour la Construction de Machines, of Liége.

The municipal central electric lighting in the town of Tongres is about to be extended. Six concerns competed for the contract, the lowest offer (£2,363) being that of the Société Internationale d'Electricité, of Liége.

Bolton.—The Electricity Committee accepted the following tenders in connection with the construction of the coal-conveying plant at the new works at Back-o'-th'-Bank :—

Coal conveyor, chutes, weighers and suction ash-handling plant.—Babcock and Wilcox.
Capstans and bollards.—Crompton & Co., Ltd.
Weighbridges.—Wm. Hodgson & Sons.
Steelwork for the bunker and viaduct.—John Booth & Sons.
Excavating, concreting, &c., and carpenter's work for the bunker viaduct.—J. & N. Dickinson.
Electrical tubes and fittings.—Credenda Tube Co., Ltd.

Canada.—WINNIPEG.—The city contract for electric meters for 1914 has been awarded as follows, being the lowest satisfactory tender in each case, namely :—

Packard.—Single-phase two-wire meters.
Ferranti.—Single-phase two-wire meters, polyphase meters.
Canadian General Electric.—Single-phase three-wire meters.
W. E. Skinner.—Direct-current meters.
Canadian Electrical News.

Derby.—The T.C. has accepted the tender of Messrs. Taylor, Whiting & Taylor, of Derby, for installing the electric light at Pear Tree schools, at £128.

Germany.—The Siemens & Halske Gesellschaft, of Berlin, is reported to have secured a contract from the American Iron and Steel Co., of Lebanon, Pa., U.S.A., for the supply of two 20-ton electric steel furnaces. They will be constructed in accordance with the Frick-Kjellin-Rochling-Rodenhauser patents, and are expected to produce about 180 tons of special steel per day.

Grimsby.—The following tenders have been accepted by the T.C. :—

Berry, Skinner & Co.—For starting apparatus, the price for one starter or panel of each size being £38.
Horace Green & Co.—For the supply of motors for two years, the price for one motor of each size being £167.

Glasgow.—The Libraries Committee of the T.C. has accepted the offer of Messrs. Alex. Wylie & Co. (£286) for the electric light installation of Langside Library.

The T.C.'s Committee on Tramway Works and Stores has recommended acceptance of the following offers :—

Insulated Brooklyn bolts.—W. C. Yuille & Co., Ltd.
Insulated stud bolts.—W. C. Yuille & Co., Ltd.; J. Hally Craig.

Liverpool.—The City Council has accepted the following tenders :—

North-Eastern Steel Co.—2,000 tons grooved Sandberg silicon steel tram rails.
Walter Scott, Ltd.—400 tons Sandberg silicon railway section rails.
Sutton Heath and Lea Green Collieries, Ltd.—Annual supply of best quality steam slack to the Lister Drive power station.

Lochgelly, &c.—Messrs. Johnson & Phillips, Ltd., have in course of erection for the Lochgelly Coal and Iron Co., of Lochgelly, Fifeshire, 3,300-volt three-phase overhead lines for transmitting power to their various collieries. The same firm have recently completed a contract for the supply and erection of overhead cable, power distribution boards and connections for some new cement works at Rainham, Kent, and have also in hand a similar undertaking for some cement works in course of erection at Cliffe, near Rochester.

London.—L.C.C.—The Education Committee reports that Messrs. G. F. Ratcliff & Co., contractors for the installation of the electric light at the Hammersmith Trade School for Girls, having withdrawn their tender (£365 10s.), owing to an error, it has accepted that of Messrs. A. Hawkins & Sons, amounting to £444.

The same committee reports having accpted tenders for installing electric lighting at seven schools for £2,173.

SHOREDITCH.—The following tenders have been received by the B.C. for the supply of two 1,500-KW. and one 500-KW. converters :—

Name.	Original price.	Remarks.	Speed, 1,500 KW. R.P.M.	Speed, 500 KW. R.P.M.
Dick, Kerr & Co. ..	£11,278	Motor-generator.	300	500
Elec. Eng. & Equip. Co.	9,131	Do.	300	750
Bruce Peebles & Co. ..	8,947	Motor converters. Tender in order.	273	500
General Electric Co. ..	8,544	Rotaries. Exciters & cables not included.	300	750
British Thomson-Houston Co.	8,357	Rotaries. Exciters, boosters and cables not included.	375	750
Vickers, Ltd.	8,172	Rotaries. No exciters or cables included.	375	750
Brit. Westinghouse Elec. and Manufacturing Co.	7,765	Rotaries. No booster included.	375	750
Siemens Bros. Dynamo Works, Ltd.	7,760 and 7,520	Rotaries. Tender in order. Alternative tender.	600	1,000

After careful consideration of a report from the borough electrical engineer, the Lighting Committee states that it is of opinion that the Council would be well advised to give the contract to three firms, viz., Siemens Bros. Dynamo Works, Ltd., for one 1,500-KW. converter; Bruce Peebles & Co., Ltd., for one 1,500-KW. converter; and the British Westinghouse Electric and Manufacturing Co., Ltd., for one 500-KW. converter, all of whom have had experience in the design and construction of similar plant, and have quoted a price at which they would be prepared to supply one machine only. Under this arrangement, there would be several advantages to the Council, especially in view of the possible future extension of converting plant. The Committee recommend accordingly.

POPLAR.—The following tenders have been received by the B.C. for the maintenance of the whole of the incandescent street lamps :—

British Economical Lamp Co., Ltd.	£999 8 0	per annum
Scholey & Co., Ltd.	497 4 0	"
Crycelco, Ltd.	680 13 0	"
Bird & Hall	843 18 0	"

The lowest tender has been accepted, the terms quoted being 3s. to 9s. per lamp point for maintenance, according to voltage and candle-power, and 1s. 3d. to 4s. 3d. for make-up lamps. The Council holds the option of determining the contract at the end of one, two or three years.

Maidenhead.—The T.C. has accepted the following tenders :—

Thos. Ward, Ltd.—Two oil fuel tanks (40 tons capacity), £110.
F. A. Greene.—5-in. low-level pump and motor, £92 10s.; 6½-H.P. motor and fittings, £46 10s.; motor and reciprocating air pump, £49 15s.

Northampton.—The T.C. has accepted the following tenders :—

Brush Electrical Engineering Co., Ltd.—450-KW. turbine and generator (one disk and drum type, turbo-dynamo), £2,370.
Worthington Pump Co., Ltd.—Condensing plant, £1,522.
Brush Electrical Engineering Co., Ltd.—Switch panel, £68.
Premier Accumulator Co. Ltd.—250-cell battery (801 amperes at 1-hour rate battery capacity), £2,168; 10 years' maintenance contract, £159 per annum.

Rugby.—The E.L. Committee of the U.D.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for cable for extensions.

Shanghai.—We understand that the General Electric Co., Ltd., through their China company—the General Electric Co. of China, Ltd.—have again secured, for the third time, the contract for "Osram" traction lamps, from the Shanghai Tramways (International Settlement).

Southampton.—The following tenders have been received by the T.C. for the supply of a surface condenser at the electricity works :—

Worthington Pump Co. (accepted)	£707	Brit. Westinghouse Elec. Co. ..	910
Do. do. (alternative)	619	Do. do. (alternative)	800
W. H. Allen, Son & Co.	885	Willans & Robinson, Ltd. ..	930
Do. do. (alternative)	780	Do. do. (alternative)	745
Cole, Marchent & Morley, Ltd.	888	Mirrlees Watson Co.	960
Do. do. (alternative)	798	Do. do. (alternative)	860
		Pollit & Wigzell, Ltd.	950

Warrington.—The Corporation has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £151, for a supply of feed pipes to the electricity works.

Watford.—The U.D.C. has accepted the tender of Messrs. Leigh & Co. for wiring the Council's cottages for electric light, at £26 2s. 6d.

Worthing.—The T.C. has accepted the quotation of the Anglo-American Oil Co. for the supply of 320 tons of fuel oil at 75s. 7d. per ton, to be delivered free at Worthing Railway Station as and when required.

York.—The Corporation has accepted Messrs. Chamberlain & Hookham's tender for meters above 10 amperes, prepayment and two-rate meters and Venner time switches.

For meters up to and including the 10-ampere size, with anti-vibrating device, the tender of the Reason Manufacturing Co., Ltd., is recommended.

FORTHCOMING EVENTS.

Greenock Electrical Society.—Friday, February 6th. At 7.45 p.m. At Temperance Institute, West Stewart Street. Papers on "Cinematograph Supplies," by Mr. W. B. Smith, and "Faults in House Wiring," by Mr. McGibbon.

Institute of Marine Engineers.—Monday, February 9th. At 8 p.m. Discussion on "Fuel Tests."

Institution of Post Office Electrical Engineers.—Monday, February 9th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment. Paper on "A Modern P.O. Wireless Station," by Mr. F. Addey.

Association of Engineers-in-Charge.—Wednesday, February 11th. At 7.30 p.m. At St. Bride Institute. Paper on "Heating of Buildings by Low-pressure and Exhaust Steam," by Mr. Kenneth Gray.

Nottingham Society of Engineers.—Wednesday, February 11th. At Welbeck Hotel, Milton Street. Paper on "Defective Boiler Mountings," by Mr. F. W. Sisson.

Concrete Institute.—Thursday, February 12th. At 7.30 p.m. At Denison House, 296, Vauxhall Bridge Road, S.W. Discussion of paper on "Factory Construction," by Mr. P. M. Fraser.

Institution of Electrical Engineers.—Thursday, February 12th. At 8 p.m. At Victoria Embankment. Paper on "Some Railway Conditions Governing Electrification," by Mr. R. T. Smith.

(Birmingham Local Section).—Wednesday, February 11th. At 7.30 p.m. At the University, Edmund Street. Paper on "Some Railway Conditions Governing Electrification," by Mr. R. T. Smith.

(Manchester Local Section).—Tuesday, February 10th. At 7.30 p.m. At University, Physical Laboratory. Paper on "The Cascade Induction Motor," by Mr. L. J. Hunt.

(Newcastle Local Section).—Monday, February 9th. At 7 p.m. At Hugh Bell School, Middlesbrough. Paper on "Suggested Methods of Improving the Telephone Service," by Mr. W. Aitken.

(Scottish Local Section).—Saturday, February 14th. At 7.30 p.m. At the Grosvenor, Gordon Street, Glasgow. Annual smoking concert.

(Yorkshire Local Section).—Wednesday, February 11th. At 7.15 p.m. At Philosophical Hall, Leeds. Paper on "The Cascade Induction Motor," by Mr. L. J. Hunt.

Manchester Association of Engineers.—Friday, February 13th. At Grand Hotel, Aytoun Street. Fifty-eighth anniversary dinner.

Physical Society of London.—Friday, February 13th. At 8 p.m. At Imperial College of Science. Papers on "Moving Coil Ballistic Galvanometer," by Mr. R. L. Jones; "Vibration Galvanometers of Low Effective Resistance," by Mr. A. Campbell, and "Vacuum-tight Lead-seals for Sealing-in-wires in Vitreous Silica and other Glasses," by Mr. H. J. S. Sand.

Royal Institution of Great Britain.—Friday, February 13th. At 9 p.m. At Albemarle Street, W. Paper on "Production of Neon and Helium by Electric Discharge," by Prof. J. Norman Collie, F.R.S.

Saturday, February 14th. At 3 p.m. Lecture on "The Electric Emissivity of Matter (1) The Metals," by Dr. J. Allen Harker.

Illuminating Engineering Society.—Friday, January 13th. At the Trocadero. Annual Dinner.

North of England Institute of Mining and Mechanical Engineers.—Saturday, February 14th. At 2 p.m. At Newcastle-upon-Tyne. General Meeting

Junior Institution of Engineers.—Saturday, February 14th. At 6.30 p.m. Annual dinner.

Salford Technical and Engineering Association.—Saturday, February 14th, At 7 p.m. At Royal Technical Institute. Paper on "Swiss Mountain Railways," by Mr. A. A. Buss.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, February 9th.—"A" Company. Technical instruction, 7 to 10 p.m.

Tuesday, February 10th.—"B" Company. Technical instruction, 7 to 10 p.m.

Wednesday, February 11th.—Recruits only. Infantry drill and technical instruction, 7 to 10 p.m. Rating examinations are held every Wednesday, from 6.30 p.m.

Thursday, February 12th.—"C" Company. Technical instruction, 7 to 10 p.m.

Friday, February 13th.—"D" Company. Technical instruction, 7 to 9.30 p.m. Special instruction on Crossley engine, 7 to 8 p.m.

Saturday, February 14th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant.
For Officer commanding L.E.E.

NOTES.

Association of Electrical Station Engineers.—Since the remarks in our leaderette on central-station salaries went to press, the London branch of the above Association has held a meeting at Stone's Restaurant, Ludgate Hill, at which between 40 and 50 members were present. After very lengthy discussion, the changing character of the members' minds having been shown by a series of resolutions and amendments, the following resolution was passed, with several dissentients:—

"Owing to the fact that the L.E.M.A. does not appear to represent the supply authorities of London and Greater London, this meeting instructs the London Committee of the A.E.S.E. to circularise all supply authorities in London, asking them to form a Committee to discuss with the A.E.S.E. conditions of working hours of labour and rates of pay by March 2nd or convenient date."

We shall refer to the matter in our next issue, but having the real interests of central-station men at heart, we would seriously suggest that in a movement of this kind, most is to be gained by adopting a policy of deliberation and tact, and by remaining unswayed by the speeches of Socialistic agitators.

Fan Patents in the United States.—We are informed that after six years' litigation in the American Courts, the infringement suit instituted by the American Blower Co., of Detroit, against the B. F. Sturtevant Co., of Boston, was ultimately decided, and judgment given in favour of the American Blower Co. by Judge Ray, of the United States District Court, on December 22nd, 1913. The suit was in reference to an infringement of the patent rights of the centrifugal fan, which is known by the trade mark "Sirocco," and which was invented and patented all over the world by S. C. Davidson, of the firm of Davidson and Co., Ltd., Belfast, Ireland. The American Blower Co. control the patent rights of the Davidson fan in America, and the infringement complained of was in reference to a fan having blades similar to those of the Davidson fan, but with corrugations along the axial length, and described by the B. F. Sturtevant Co., who were making and selling it, as their Multivane fan. The Judge decided that the patents in suit disclosed invention and were valid, and that the infringement was clear, and gave the decree in favour of the American Blower Co., with costs. The case was not only a very protracted one, but included a formidable array of witnesses, amongst whom were the most brilliant scientists of America. The evidence forms a library of 10 volumes, aggregating about 3,000 pages.

Senghenydd Disaster Inquiry.—On Friday last the Home Office inquiry into the explosion and fire at Senghenydd Colliery was resumed at Cardiff, by Mr. R. A. S. Redmayne. Evidence was given that the use of electric lamps would tend to reduce the number of accidents from falls of roof and sides, and that lamps should be relighted only on the surface. On Saturday the inquiry was suspended until Thursday, February 5th. A special Delegate Conference of the South Wales Miners' Federation was held on Monday at Cardiff, to consider a number of proposals for new safety regulations prepared by the Council of the Federation, including one urging that electric lamps be adopted generally, and another, that the use of electricity for motive power in mines be totally prohibited.

Wages of L.C.C. Employés.—The Highways Committee of the L.C.C. reports that applications for alterations in conditions of labour were recently received from the undermentioned grades of employés in the rolling-stock section in the tramways department:—(1) Wiremen; (2) labourers; (3) brakesmen and re-wheelers; (4) plough repairers; (5) solderers; (6) magnet and coil winders; and (7) steam lorry drivers. The Committee, however, is of opinion that the requests should not be acceded to, and the men having asked that the matter may be referred to the appropriate conciliation board, it recommended that that course be adopted.

Institution and Lecture Notes. — Institution of Electrical Engineers.—The following corrected programme has been issued :—

February 12th, R. T. Smith. — "Some Railway Conditions governing Electrification."

February 26th, F. Lydall.—"Motor and Control Equipments for Electric Locomotives." (Note :—Mr. Lydall's paper on "Electric Locomotives," published in No. 222, Vol. 51, of the *Journal* will also be discussed at this meeting.)

March 12th, H. E. O'Brien.—"The Design of Rolling Stock for Electric Railways."

March 19th.—Discussion on "Electric Battery Vehicles."

March 26th, H. R. Speyer.—"The Development of Electric Power for Industrial Purposes in India."

April 2nd, H. G. Brown.—"Electric Signalling on Railways."

April 23rd, H. W. Firth.—"Electrification of Railways as affected by Traffic Considerations."

(Students' Section).—February 18th, W. H. Date.—"Illumination in Theory and Practice."

At a meeting of the Scottish Local Section, in Glasgow, the chairman, Mr. G. A. Robertson said that the Committee had arranged the following programme for the second portion of the session :—At Glasgow, on February 17th, Mr. Roger T. Smith would read a paper entitled "Railway Conditions Governing Electrification," the first of a series of papers on electrification which were to be read in London. On March 10th, at an informal meeting in Edinburgh, there was to be a discussion upon "Some Methods of Improving the Power Factor in Alternating Currents," and on February 24th there would be an informal discussion in Glasgow on "Battery Vehicles." On April 7th, in Glasgow, Mr. A. M. Taylor, of Birmingham, would read a paper entitled "Transformers for the Simultaneous Changing of Frequency and Pressure of Alternating Circuits." This was a very important paper On April 21st (the date of the annual meeting) they were to have a paper, by Mr. Peck, of Manchester, on "Reactances in Alternating Current Circuits."

At the monthly meeting of the Section in Edinburgh on Tuesday, February 3rd, Mr. B. Welbourn read his paper on "British Practice in the Construction of High-tension Overhead Transmission Lines"

At the meeting of the Birmingham Local Section on Wednesday last week, a paper was read by Mr. T. Ferguson, A.M.I.E.E., on "Electric Train-Lighting Systems." The discussion was closed.

Society of Engineers (Incorporated).—On Monday, February 2nd, the premiums awarded for papers published during 1913 were presented, including a Society's premium, value £3 3s., to Mr. Wm. Yorath Lewis for his paper on "The Tram *v.* Bus Controversy." Mr. H. C. H. Shenton was then installed as president, and delivered his inaugural address, which he opened by referring to the need for better organisation of the engineering profession and the consideration that the Society was giving to the subject with the view of promoting the well-being of the engineer.

Association of Electrical Station Engineers.—The first annual smoking concert of the London branch was held at Stone's Restaurant on January 28th, and a large number of station engineers, representing 90 per cent. of the supply authorities in London, were present. A number of artistes who volunteered their services from amongst the station engineers, gave the assembled company a very enjoyable evening. The Hon. Secretary took the opportunity of stating details of his action at the London Electrical Masters' Association meeting the previous evening, and the reasons for the same.

At Christ's College, Cambridge, on January 30th, Mr. Hugo Hirst, chairman of the G.E. Co., lectured on "The Manufacturer and University men."

Association of Consulting Engineers (Incorporated).—The inaugural dinner of the Association was held on Monday last, at the Whitehall Club. A report of the proceedings will appear in a later issue.

Copper.—The end of January sees copper inclined to rise, in company with other securities. Messrs. Merton's statistical circular shows total deliveries for the month at 42,490 tons, not a high figure, considering present rates of consumption. English stocks were decreased by 1,089 tons during the month, French by 1,480, a large proportion. European visible supplies (including Rotterdam, Hamburg and Bremen, but excluding estimates for other ports) are now 25,944 tons, 3,576 tons less than at the end of January. During the month American deliveries have been very near average, Spain and Portugal over the average, Chile shipments slightly under, Australian a good deal below the average. Stock in American producers' hands for the end of December showed an increase of 19,424 tons on the figure for the end of November. The world's visible supplies at the end of December showed 70,341 tons, an increase of 22,187 tons on the figure for the end of November.

Appointments Vacant.—Switchboard attendant, for Portsmouth Corporation (30s.); electrical fitter for Government waterworks on the Gold Coast, age 25-40 (£300); assistant electrical engineer, for Singapore Electric Tramways, Ltd. ($300 month); switchboard attendant, for Lancaster Corporation (27s. 6d.). Particulars are given in our advertisement pages.

For Sale.—King's Lynn Corporation electricity department has for disposal four 90-B.H.P. gas engines, one compressed-air vessel, two vertical boilers, &c. Particulars are given in our advertisement pages to-day.

Fatalities.—At the inquest on a fitter, named Uttley, who was killed at the electric generating station of the Burnley Co-operative Society, it was stated that he had been called in to effect repairs to the engine. These had practically been effected, when he asked for the steam to be turned on. The society's assistant engineer turned this on at the boiler, but by some means no one was able to explain, the engine valve was slightly open, so that the steam came through and accumulated. Uttley, to fix a pipe, put a foot on a spoke of the wheel, evidently having forgotten his order about the steam, and the result was that the wheel began to revolve, and he received fatal injuries. The Factory Inspector said the safest course was to block all wheels until everything was ready for a trial. A verdict of "Accidental death" was returned.

The adjourned inquiry into the cause of death of the banksman, Charles William Walker, through an electric shock at the Digby Colliery, near Nottingham, was held on January 27th, and was attended by Mr. Nelson, of the Home Office. According to the *Sheffield Daily Telegraph*, evidence was given by George Ernest Dawson, assistant electrician, to the effect that he heard someone shout there was a man fast on the wire. Witness ran and found the man standing in an upright position with his left hand on the wire. He was unable to speak, and artificial respiration was tried until the arrival of the doctor. Mr. Phillips, manager of the Notts. and Derbyshire Electric Power Co., from which source the colliery is supplied, agreed with Mr. Nelson that a separate transformer should always be used for lighting; that the pressure should always be as low as possible; and that in every insulated circuit a fault detector of some kind should be installed. A verdict of "Accidentally killed" was returned.

A Repulsion Fuse.—A fuse which has been developed by the Metropolitan Engineering Co., Brooklyn, N.Y., consists of zinc ribbon bent in the shape of a U over a thin mica separator, with constrictions at the bend, so that upon rupture due to overload the fuse is broken in two parallel strips of equal length, one on either side of the separator, and each with its upper end free. Since the current in the parallel legs of the U flows in opposite directions, a force of repulsion is exerted between the two. The ends of these legs are fixed, but after fusion the ruptured ends are free, and movement is possible at the ends where the arc occurs. The force actually resulting is considerable, and can, for any definite condition, be calculated from the formula—

$$F = 4\ \pi\ I^2 / 100\ d = \text{dynes per centimetre},$$

where d is the thickness of the separator, and I is the current flowing. A 60-ampere fuse, by calculation from oscillogram records, would, under short-circuit conditions, generate a repulsive force as great as 190 lb. The greater the overload, the more widely the fused ends become separated, resulting in a prompt suppression of the arc. In addition to the fundamental principle of repulsion, two other principles are utilised, namely, the magnetic blowout and a tendency of the metallic vapours produced at the rupture to force the limbs of the fuse apart. The magnetic blowout is quite noticeable at moderate overloads, but is masked by the repulsive effect at great overloads. The effect of the expanding gas has been traced in some tests, but is not a very important feature. The complete fuse consists of a porcelain fuse-holder, an insulating barrier, a fuse element and copper contact plates.—*Electrical World.*

[The calculation appears to be at fault. By the formula given above, assuming that the short-circuit current I reaches $10 \times 60 = 600$ amperes, and that the distance d between the limbs of the fuse is 0·1 cm., the force $F = 0{\cdot}1257 \times 600^2/0\,1 = 452{,}500$ dynes. If the fuse is 10 cm. long, the total force tending to separate the limbs = 4,525,000 dynes = about 10 lb., and the effect of this is roughly equivalent to a force of 5 lb. exerted between the ends of the limbs. To obtain a total force of 190 lb., a short-circuit current of 1,000 amperes and a total thickness of separator of $\frac{1}{100}$ in. must be assumed, conditions which are certainly not practical. In point of fact, however, we believe the formula quoted gives values much in excess of the true force. We do not doubt that the fuse acts as claimed.—Eds. Elec. Rev.]

Educational Note. — North-East Coast Institution of Engineers and Shipbuilders.—A scholarship will be offered for competition among graduates of the Institution in September next, tenable for two years, and of the annual value of £50. The scholarship will be awarded on the results of an examination held in Newcastle during the month of September in English, mathematics and experimental science. Every candidate must be a British subject and a member of the Graduate Section of the Institution of not less than one year's standing, and shall have served or be serving an apprenticeship on the North-East Coast. Particulars may be had from the Secretary, North-East Coast Institution of Engineers and Shipbuilders, Bolbec Hall, Newcastle-on-Tyne.

Electric Engine Starters for Motor-Cars. — We have previously referred to the fact that electric engine starters are being very extensively adopted in America, it being estimated that about 70 per cent. of the cars now being built in the United States are equipped with engine starters. The arrangement in which the pinion of the starter drives the engine through a gear ring on the fly-wheel is the most poplar method, it being found on 62 per cent. of the cars. In 15 per cent. of the cases the starter drives through chain or gearing on to the crankshaft, and in 13 per cent. the power is transmitted to the timing gear; in the remaining 10 per cent. of the cars various special driving methods are adopted.

(*Continued on page* 235.)

RECENT DEVELOPMENTS IN ELECTRICITY SUPPLY IN HULL.

For some years past the increasing demand for electricity has been one of the features of modern industry, and it is a recognition of this fact which recently led the Hull Corporation to embark on a far-reaching scheme for developing its electricity undertaking.

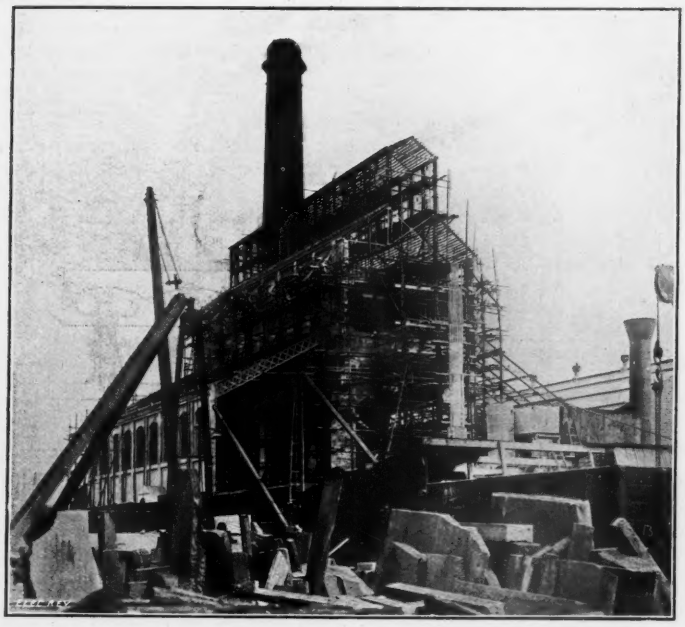


Fig. 1.—View showing New Reinforced Concrete Power Station under Construction, Hull.

Modern Hull, with its population of some 300,000, owes its progress not alone to its position as third port in the kingdom. Apart from shipping it is an important centre for flour milling, but its chief industry is probably seed crushing, oil extracting and refining, and paint, colour, &c., manufacturing. In addition, there are the engineering and shipbuilding trades, cement manufacturing and various miscellaneous industries, an outstanding example of which is Messrs. Reckitt's colossal business, employing some 4,000 hands locally.

From all of which it will be gathered that the Corporation was amply justified in taking the necessary steps to provide for the electrical future of the city and its surrounding neighbourhood.

The scheme of extensions, of which the initial stages have been undertaken at a cost of some £100,000, provides the city with a modern three-phase supply, with a system of ring-mains and sub-stations in the most important industrial areas, and supplements the existing H.T. direct-current supply, which has formed an outstanding and oft-criticised feature of electricity supply in Hull in the past. To do it justice, the H.T. direct-current system of supply generating at 2,200 volts, with rotary sub-stations dotted about the city, which can be started up, regulated and controlled, from the generating station, has reached a highly developed stage—thanks largely to the attention bestowed on it by Mr. Bell, the city electrical engineer—and has abundantly proved its reliability in service.

The development of the undertaking in recent years is ample evidence of the latter fact, but Mr. Bell's adoption of the three-phase system for extensions has been due most of all to the greatly decreased capital cost and increased flexibility of the latter system.

Hull, in its numerous docks and factories, offers many opportunities for power supply at a competitive price, for which the electricity department will in the future be most favourably placed.

The recent extension at Sculcoates Lane, which adjoins the older station there, and of which the first portion only has been undertaken, will, according to present intentions, contain eight turbine sets and 16 boilers.

Buildings.—These are of particular interest, being of reinforced concrete throughout, and including a spacious engine room, 65 ft. wide and 107 ft. long, which adjoins and opens into the older engine room; a boiler house of 100 ft. span and 90 ft. long, switch-house, offices, &c. Temporary ends have been provided to the present buildings which constitute about half the ultimate scheme.

As the subsoil consists of soft clay upon a bed of peat, it was necessary to pile the whole site, and 400 pitch pine piles were used for the purpose. The turbine and condenser foundations are of mass concrete resting on a cluster of piles; the engine house walls are of 5 in. thick, reinforced by ½-in. rods both vertically and horizontally, and stiffened by 24 in. × 12 in. pilasters at intervals, each of which contains a 12 in. × 6 in. steel joist. The feature of the boiler house is the bunker construction, which occupies the centre of the roof portion of the building, the first half being designed to hold some 2,000 tons of fuel. Owing to the boiler arrangement, only six reinforced concrete stanchions could be provided,

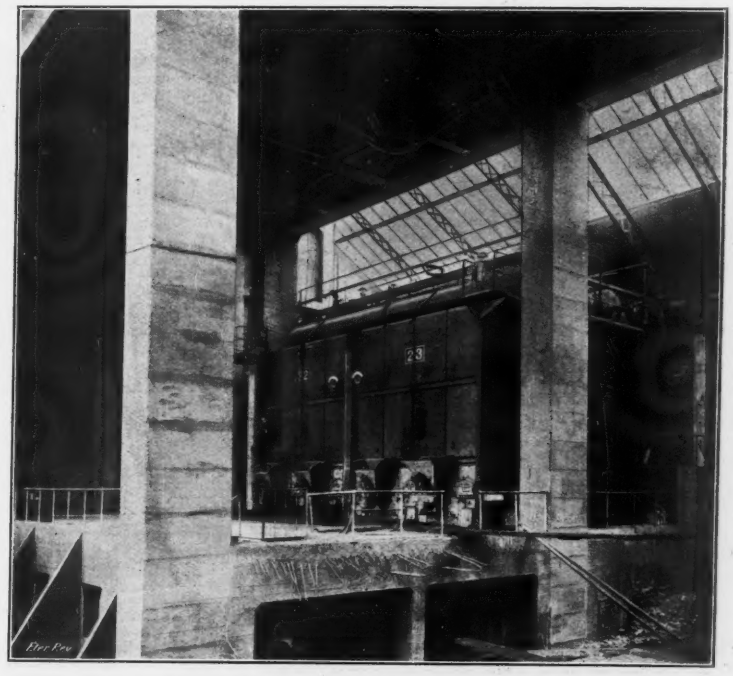


Fig. 2.—The Boiler House, showing Woodeson Boilers, Concrete Coal Bunkers, &c.

each 5 ft. × 3 ft. × 44 ft. long, to support the bunker structure, which is 35 ft. wide, 33 ft. high, and 95 ft. long. The bunkers have 7 in. reinforced concrete sides and hopper bottoms with 18 in. outlets; the top of the bunker is formed

by a steel truss roof carrying a conveyor chamber 12 ft. 6 in. wide × 10 ft. 6 in. high.

Beneath the firing floor of the boiler house an ash basement is provided. The buildings are fireproof practically throughout, and were designed by the Hull city engineer.

A considerable area of land has been acquired adjacent to the present site, where it is intended to place cooling towers,

The Woodeson boiler is of exceedingly simple construction, consisting in the main of three sections, each comprising an upper steam drum and lower mud drum, connected together by eight nests of 19 3-in. diameter straight tubes.

The tubes are all straight and of the same length and bore, and can be withdrawn through manholes opposite each

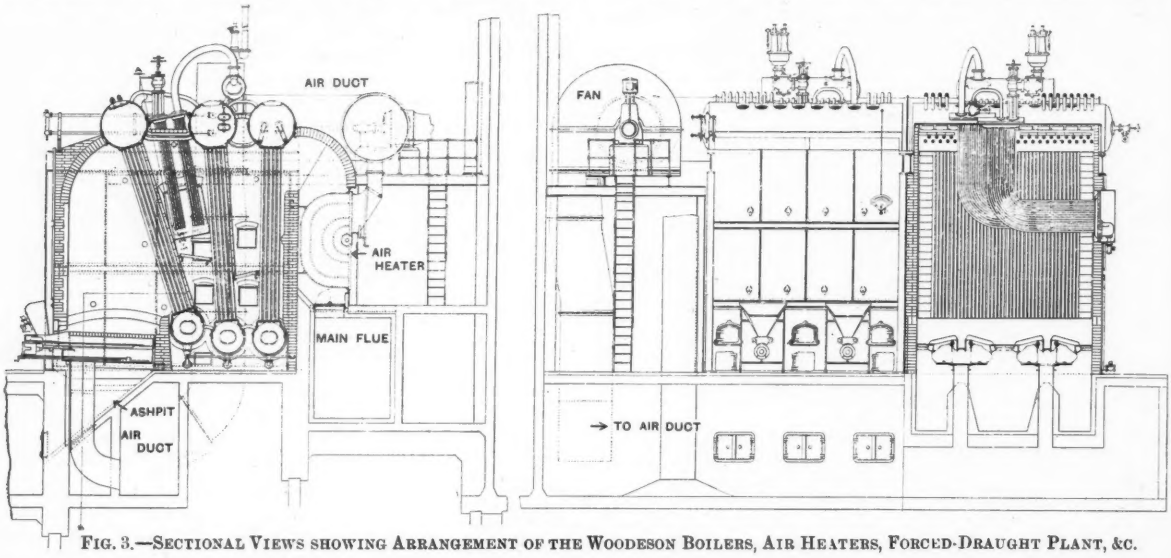


Fig. 3.—Sectional Views showing Arrangement of the Woodeson Boilers, Air Heaters, Forced-Draught Plant, &c.

store coal and when necessary build a further generating station.

New Plant.—In the boiler house, shown in fig. 2, are installed two Woodeson patent water-tube boilers, by Clarke, Chapman & Co., each having 6,100 sq. ft. heating surface and 105 sq. ft. grate area, and capable of evaporating 30,000 lb. of water per hour at 180 lb. pressure.

Woodeson integral superheaters are fitted, to give 170° of superheat to the steam, and Underfeed stokers, the latter working in conjunction with "Usco" air heaters, which are fitted in the flues at the back of the boilers; the air is drawn

nest of tubes; the tube sections are hung from girders, and are free at the bottom ends to allow of expansion. A good feature is the lofty combustion chamber which occupies the front of the boiler.

A semi-automatic ash discharge is provided for each boiler, the ashes falling into hoppers, from which they automatically discharge into trucks and are tipped into a storage hopper for subsequent removal by a grab crane.

The Sculcoates Lane generating station is conveniently situated for both fuel and water supplies, as it adjoins both

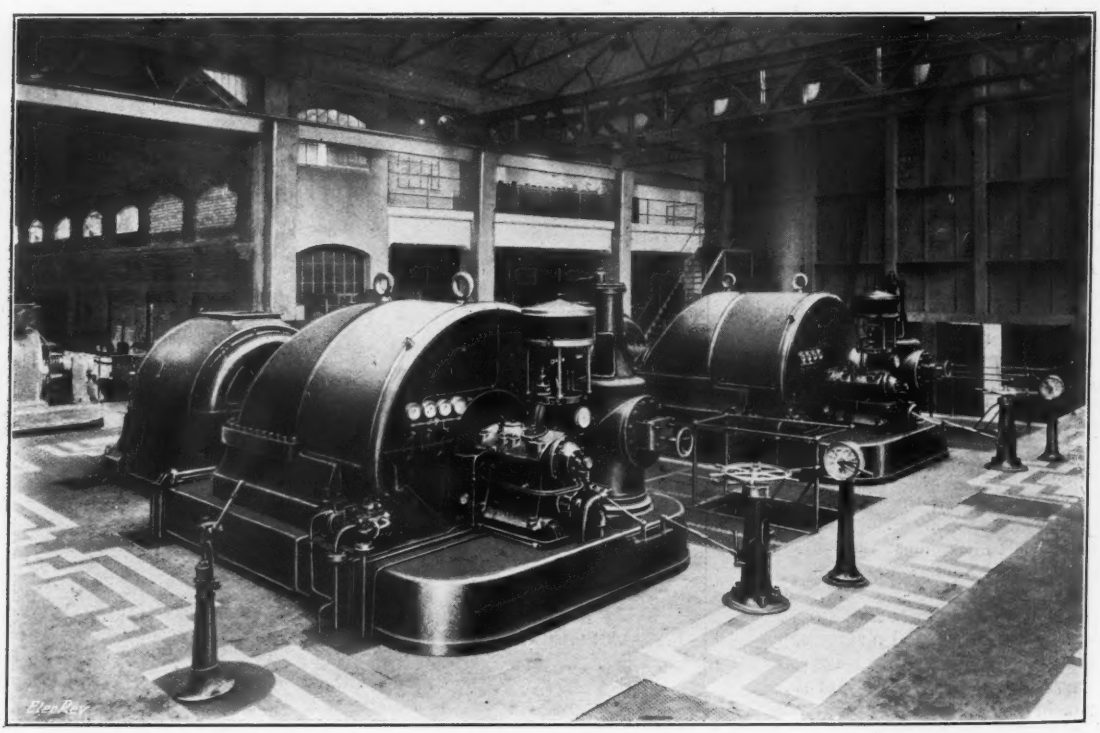


Fig. 4.—Interior of Engine Room, showing Dick, Kerr-Bergmann Turbine Plant, Hull.

through these heaters by a 50-H.P. fan, which is sufficiently large for two further boilers, and is delivered under pressure and at a temperature of 250° F. to the furnaces. Fig. 3 shows the arrangement of the air ducts between the air heaters, fan and furnaces.

the Hull and Barnsley Railway and the Beverley and Barmston Cut—the latter a large fresh-water drainage canal. A coal siding runs into the works, and when the present initial boiler equipment has been extended sufficiently to justify it, a conveyor plant will be installed to supply the

overhead bunkers from a hopper in the yard, which will be filled from wagons on the works sidings. The fuel used is South Yorkshire unwashed slack, costing 10s. 7d. per ton.

The feed-water supply for the entire plant, new and old, is obtained from the Beverley Cut, being both softened and filtered before use. In connection with the new boiler plant a Woodeson direct-acting steam pump, of 12,000 gallons per hour capacity, has been installed, which temporarily draws from the feed tank in connection with the old boiler house, and in the same way the gases from the new boilers are led through existing economisers to an existing 210-ft. chimney, although the designs for the new boiler house contemplate a steel stack midway along each side of the new boiler house.

We understand that at a later date it is intended to utilise a portion of the exhaust steam from the generating plant for direct feed heating, in view of the use of ejector condensers, and that designs have been prepared for this.

In the engine house two 2,000-KW. Dick, Kerr (Bergmann type) turbo-alternators are installed, as shown in fig. 4), in conjunction with ejector condensers, this type of condenser having been adopted throughout the old and new plants.

The turbines are of the impulse type, and run at 1,500 R.P.M., requiring 15 lb. of steam per KW.-hr. on full load. Four steam nozzles are normally open, governor controlled, while the steam admission can be hand regulated on a further series of nine nozzles. A small duplex steam-driven oil pump is provided to each turbine for flushing the bearings when starting or stopping, and by means of the action of an oil relay, the governor valve shuts down if the oil pressure system to the bearings fails.

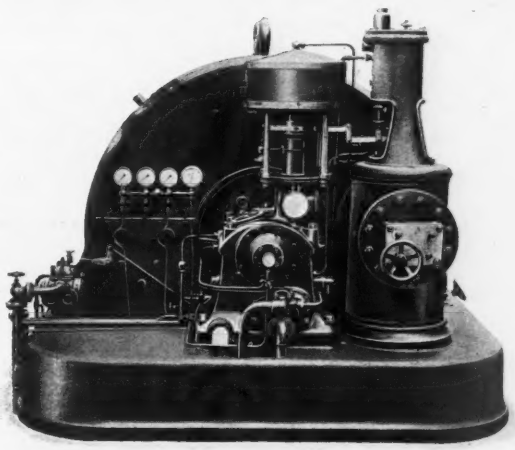


FIG. 5.—GOVERNOR GEAR AND ADMISSION VALVES, DICK, KERR-BERGMANN TURBINE.

FIG. 6.—E.H.T. SWITCH CONTROL GALLERY, SHOWING BENCH BOARD.

The alternators, which are three-phase machines of the four-pole salient-pole type, generating at 6,600 volts and 50 cycles, are designed to give 2,000 KW. at ·8 power factor; in each case an extension of the main shaft drives a direct-coupled 13½-KW. 110-volt four-pole exciter.

(To be continued.)

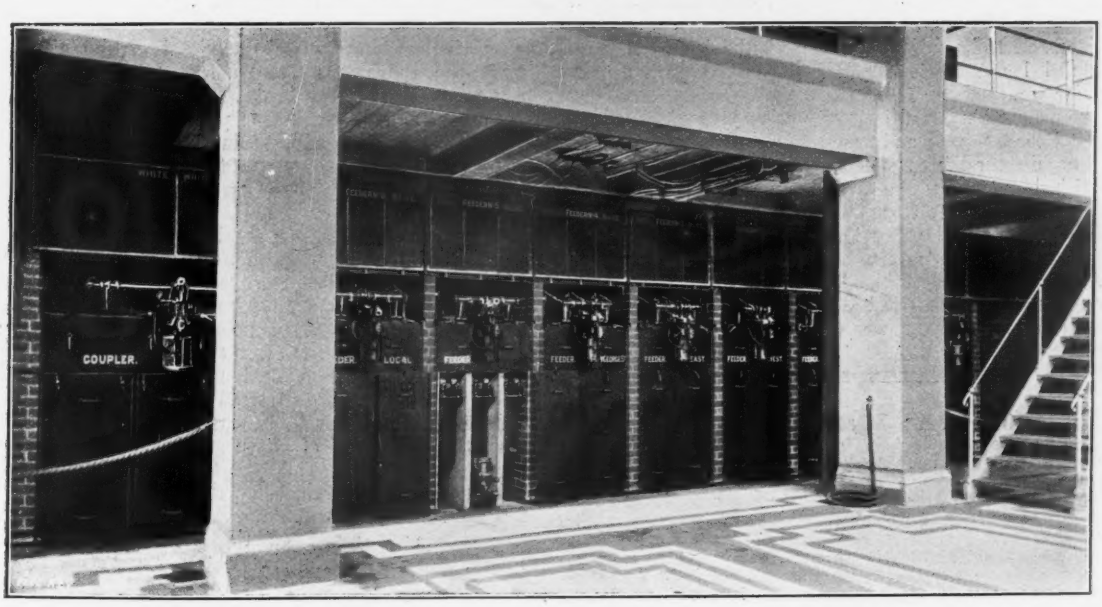


FIG. 7.—WESTINGHOUSE THREE PHASE OIL SWITCHES AND CUBICLES, HULL.

THE NEW HOME OF THE CIVIL ENGINEERS.

By courtesy of the Institution of Civil Engineers we are able to print the accompanying view of the new building of that Institution as it will appear when completed. As our readers know, the former premises—25, Great George Street—were relinquished to make way for the new Government Buildings. The foundation stone was laid in October, 1910, by the then president, Sir J. C. Inglis. The main entrance of the buildings is in Great George Street, where it has heavy ornamental iron gates surmounted by a carved group supporting a shield which bears the arms of the Institution with the motto: "Scientia et Ingenio." The new premises will cover an area of about 22,700 sq. ft. For the electric lighting of the buildings Mr. E. W. Monkhouse has acted as adviser. With the exception of the lecture theatre, the lighting of the larger rooms, halls and corridors, electroliers will be used; in the lecture theatre concealed lamps are arranged in the cornice for reflected illumination.

New Building, Institution of Civil Engineers, Great George Street, S.W.

The picture illustrated is a perspective view of the north (Great George Street) and west (Princes Street) elevations. The architectural features at the north-west angle are yet unfinished. Completion is dependent on the termination of the lease of No. 1, Great George Street, the removal of which premises will also allow the projected widening of this part of Princes Street to be effected.

As constructional operations are still in progress, we defer our account of the electrical installation and other features of engineering interest to a later date.

The Moffat-Irving Electric Furnace.—A new type of furnace has recently been introduced by the Moffat-Irving Electric Smelters, Ltd., of Toronto. The ore, limestone and carbon are mechanically fed into the furnace in a finely-divided condition, the former two falling some feet to the hearth, through CO gas at a temperature of over 2,000° F., given off from the furnace, while the carbon is fed in at a lower level. Three-phase current is used, about 2,500 amps. at 70 volts pressure, and the power factor is approximately 90 per cent. The electrodes are hand regulated, and are of graphite, 5 in. in diameter. It is claimed that a superior quality of steel is obtained.

THE RUBBER MARKET.

The rubber market has shown a much more cheerful aspect lately, and there has been a decided growth of confidence regarding the position generally, thanks in no small degree to the improvement in sentiment. Rubber has been possibly worse hit by the fit of gloom which has overspread all the commodity markets, than anything else, but the tendency has within the last few weeks become more hopeful, and with the continued satisfactory statistical position, and the steady demand for material from the trade, the outlook is certainly far from being discouraging for holders of shares in plantation rubber companies. The feeling is indeed growing that the market may quite easily be on the verge of really good times, for demands have proved all absorbing, and there has been a great deal of resistance shown to the decline in prices at round about the present level. The knowledge that the slump in the price has put out of effective operation the bulk of the wild rubber countries as contributors to the world's supplies, is gradually forcing itself upon the minds of consumers of the material, and holders of shares, and it is indeed almost certain that there will be an appreciation of prices as the year proceeds based upon the actual strengthening of the statistical position. The possibilities indeed are considerable on the bull side of the market, and have been dealt with succintly by the leading authority on the article, the *India-Rubber World*, the Singapore correspondent of which journal has gone very thoroughly into the matter. He says that the yield of the mid-Eastern plantations for last year was about 45,000 tons, and would have been 50,000 tons but for the slump. If the low prices continue, no new areas will be brought into tapping at all in 1914, so that only a normal increase on the present tapped areas will ensue, yielding, say, 55,000, to at most 60,000 tons instead of 70,000 tons or more. The Brazilian output will, he says, be down at least 10,000 tons, the production of guayule rubber is no more for the present at any rate, while the Congo and East and West Africa will only produce a few thousand tons at most, in place of 20,000 tons odd. Borneo rubber and Jelutong are already simply wiped off the slate by the low prices ruling, and Central America will not produce anything approaching the estimated quantity. The present year has, therefore, opened with the prospect of a

total crop of 100,000 tons to 110,000 tons in place of the 140,000 tons which manufacturers had been counting upon, and the inevitable result will be that prices must advance when once the buying impulse begins to be felt. There is hardly any chance of operations as regards the gathering of wild rubber being increased to any extent this year, for the collection of this material has ceased to spell anything but ruin to those engaged in it, and 1914 is likely, therefore, to be a bare year. The only wild rubber which, as things stand to-day, has a chance of surviving, is fine hard Para, every other kind having been practically knocked out by the price. There is another point, too, and that is that unless present prices improve, there is a certainty that some of the plantations will shut down altogether for a period, for it simply does not pay to tap the trees when rubber is selling round 2s. 3d. a lb. or so. Costs of production are naturally being reduced steadily, but considerable difficulties are being met with in some directions in this respect, and it will take time before there is an all-round reduction to an average of, say, 1s. 6d. a lb. Still the intention is, if possible, to bring down the costs to about 1s., and progress in this direction will continue to be made.

PROSPEROUS TIMES AND NEW INVENTIONS.

The curve relating the state of trade and the production of new inventions has yet to be drawn, and it would require a dogmatist of no mean order to lay down any hard and fast rule defining supply and demand in industrial inventions. At the same time there is such a thing as a law of probabilities, and we may fairly ask whether the recent happenings in the electrical industry have encouraged or discouraged inventive fertility, and following from this arises a further question as to the probable standing of the electrical industry in, say, two or three years' time.

The last few years in the electrical, as in many other manufacturing pursuits, have been a time of most remarkable prosperity, so that we call them the "boom years." It would appear that some of the prophets are of the opinion that this boom is drawing to a close. By this we do not necessarily mean that a period of depression is to ensue, but that possibly trade will not continue at quite such a high level as it has recently attained. In making this statement we are open to correction, but if this is the case it should be pointed out that just as the period of trade prosperity need not necessarily be world-wide, so the period of comparative depression may also be local to a country; in other words, while it is necessary to say that reaction must inevitably follow action, and hence we must be prepared inevitably for a partial drop, a wise economist, at any rate from his own point of view, will endeavour to localise the drop as far as possible, and endeavour so far as in him lies, to see that the locality at which the drop happens to occur, is not the one in which his own business operations are situated. For this reason the problem of the possible drop resolves itself once again into the elements of national commercial competition, and it is well to examine briefly the reasons which would tend to keep a good proportion of the total available world trade in British hands.

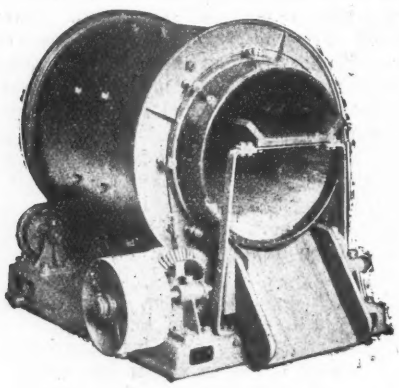
In this connection we may compare commerce to a system of parallel electrical conductors. Given a certain potential at the ends of such a system, the current flowing through the various branches of the system divides itself up inversely as the resistance in each branch. Suppose that the potential fluctuates, and it is required to keep the current in one particular branch as high as possible, it is obviously useful to reduce, as far as possible, the resistance in that branch. Transferring the analogy to terms of commercial economics, a certain world demand has to be met which may be likened to the potential. The various trade organisations of different countries are the different circuits through which the demand is supplied. The competition between them may be represented by the parallel action of such circuits. If we in Great Britain are under the impression that the world demand is likely to fall, obviously we must do something to remove every possible obstacle lying between the vendor and the purchaser. Now where various countries are each in a practically equal position, as regards manufacturing resources, to supply electrical goods capable of satisfying the needs of the market in a commercial manner the resistance of the various circuits, according to the analogy, can be said to be equal; that is to say, there is no reason why the current of trade should flow more strongly in one country than in the other. But if one country by wise prevision has made arrangements to give additional inducements to possible purchasers when the need arises, that nation stands a better chance of securing the larger volume of trade. We suggest that at this point a large proportion of the British firms fail to exercise that foresight which is necessary. Without attemping in any way to disparage the enterprise of a good many of our own leading firms, it is necessary to point out that on the Continent, and especially in Germany, a great deal of systematic attention is paid on the part of electrical manufacturers to research work, which, although not yielding direct results at the moment, is calculated to become very useful when strenuous conditions prevail, and when the customer has to be tempted either on the score of novelty, increased convenience, a slight improvement in efficiency or some other consideration, to branch out by buying apparatus differing slightly from that which is at the time regarded as standard. In other words, the most effective way of lowering the resistance between vendor and purchaser, when the commercial motive force is falling, is to have in readiness improvements and variations on standard practice calculated to arouse interest and the desire to purchase.

At this point the value of the inventor comes in. The inventor is frequently regarded as an obnoxious animal to be suppressed where possible, but he has his uses. An ignorant inventor is, of course, impossible, but the history of electrical engineering is studded with names of brilliant men who have through long years of discouragement and very slight, if any, financial assistance, brought out inventions which have laid the fortunes of commercial prosperity, not always for themselves, but certainly for the industry at large. It is this type of man—the well-trained engineer invested with that touch of imagination that converts a hint of the present into the success of the future—who has in other countries been incorporated into the research staff of important undertakings, and who has been supported in a systematic manner during the necessary period of investigation and modification, in the hope of ultimate success.

In this country such workers and the firms who make them possible are all too rare, and the recent trade boom may, unless attention is drawn in time to the danger, have the effect of inducing manufacturing firms to believe that the appliances which have sold so well for some period are the last word, and that it will be possible to continue to sell these appliances without further research. If prosperity has the effect of stultifying research and invention, it will be a very bad day for this country that we ever had any more money than we knew what to do with. In this connection it is rather an ominous sign that so much of the nation's wealth is being transferred to enterprises situated outside the limits of the country and even of the empire. At the present time the bank balances of many of the manufacturing concerns of this land are, we believe, in a very healthy condition. Unless our survey is mistaken, the rate at which firms are introducing appliances involving a distinct advance in our knowledge of electrical engineering is falling, and we suggest that the relation between the inventor and the manufacturer at the present time may be that the latter is more inclined to transfer his money to development work outside the kingdom than to expend it on research work for the purpose of building up his business in the future. If this is the case it is a very grave symptom which requires a strong counter policy, as we believe that without an active and most strenuous campaign in the direction of real and valuable research work, heavily backed financially by the resources at the command of many of our firms at the present time, Great Britain stands in some danger of falling into the second rank of electrical producers in years to come. Much has been said recently concerning co-ordination between our technical colleges, universities and manufacturing firms. Would it not be possible to translate words into action on such an important issue?

A MAGNETIC SEPARATOR.

An interesting type of magnetic separator which is made by the Hardy Patent Pick Co., Ltd., of Sheffield, consists of a cylinder placed with its axis not quite horizontal, but with one end higher than the other so that, when revolved, material introduced at the highest end will gradually make its way out at the lower end. This cylinder is placed upon rollers which allow it to be easily revolved and leaves the inside without obstruction for the passage of the material through it. Inside the cylinder are about eight magnets extending along the greater part of its length, and forming slightly projecting ribs inside it in the direction of its length. These magnets are excited by a dynamo with which they are automatically connected and disconnected during the rotation of the cylinder. The tray or shoot is fixed inside the cylinder near the top, but it is not connected with the barrel in any way. The electric connections are so arranged that while the magnets in the revolving cylinder are passing over the shoot, they are disconnected from the dynamo, and so drop on to the tray any pieces of iron or other magnetic substance which they have



Magnetic Separator.

picked out of the material. During the remainder of their revolution with the barrel they are in connection with the source of electricity supply and thus are magnetised and are ready to pick out any magnetic substance.

It will easily be seen that in this process the material is turned over and over many times as it passes through the interior of the cylindrical separator, and it is estimated that a piece of iron, from entering one end of the separator, would have to pass over the magnets about 120 times before it could escape at the other end. It is thus impossible for a piece of iron to pass through the separator without coming into contact with the magnets, as these magnets will pick up and deposit on the tray pieces of iron varying from the size of a small nail to a weight of many pounds. It is stated that almost all the iron is picked out by the time it has travelled with the material about 6 in. from the entrance end of the cylinder, and as the barrel is about 6 ft. long, there is plenty of spare room for safety. The separator barrel is driven at a normal speed of about 12 R.P.M. by means of gearing from a first-motion shaft running at 210 R.P.M. The power required to drive the separator is about $\frac{1}{4}$ H.P., and that for the dynamo is about $\frac{1}{2}$ H.P. Several of these machines have been supplied to the British Admiralty, and they can be used for almost any kind of material. They are especially useful in connection with grinding machinery, as the loss entailed by breakages caused by iron getting into the grinding plant is well known.

Manchester Electro-Harmonic Society.—The fifth concert of the season takes place on Friday, February 20th. The artistes will be as follows:—Soprano, Madame Louie Fidler (Hallé Concerts); tenor, Mr. Sam Hempsall, London (Ada Crossley and Marie Hall Tours); flautist, Mr. J. F. Ridgway; entertainer, Mr. Harold Marsden; at the piano and accompanist, Mr. E. Bennett North.

DISTILLING TURPENTINE BY ELECTRICITY.

By G. BASIL BARHAM, A.M.I.E.E.

One of the lesser known uses to which electrical energy can be applied is the distillation of turpentine. Wherever fir trees are to be found which contain a sufficiently large quantity of turpentine and where electrical energy can be obtained at a sufficiently low rate, not only satisfactory, but highly profitable results can be obtained. In fact, it is not necessary for a supply of energy to be available at the forest, for providing the cost of carriage is not excessive, the trees, or, if the trees are of greater value for other purposes, the refuse, such as chips, sawdust, &c., can be brought to where electrical power can be obtained, and the turpentine can then be profitably extracted. It is claimed that the results of work which has been actually carried out in this direction have been eminently satisfactory. The turpentine, after tests by chemists and painters who have used the product both for inside and outside work, is pronounced to be equal, if not superior, to the turpentine distilled from the long-leaf pine of the southern counties of the United States. From one cord of the resinous wood treated it is claimed that the tar oil, resin, pitch and charcoal (the by-products) more than pay the cost of the distillation of the turpentine, which is sufficient to show the value of the process from a commercial point of view. Accounts differ as to the actual value of the amounts of by-products obtainable from one cord of wood, but in one distillery there were as follows:—Resin, 60 lb.; tar oil, 20 gals.; charcoal, 1,300 lb. The oil is used for wood preservative, and is also manufactured into shingle stain. The charcoal, having been coked and cooled in a can out of contact with the air, is very perfect and valuable for use as fuel. The plant in question is of sufficient capacity to treat forty cords of wood per day. It is claimed that one cord of wood, costing approximately £1, yields, when treated electrically, pure turpentine, tar oil, resin, charcoal and pitch to the aggregate value of £5. The cost of timber, treating and marketing the products amounts to total slightly under £2 10s., so that the plant in question is returning, roughly, about 100 per cent. profit.

The principal difficulties in the process of distillation which have to be encountered are, it appears, those connected with the necessary close regulation of heat. The close regulation which is rendered possible by the use of electricity suggested its adaptation to the purposes of distillation, and a plant was laid down in Vancouver some little time ago to deal with the fir trees of the North Pacific coast, which contain a very large percentage of turpentine.

Electrical energy was obtainable at a low cost on account of the abundance of water power, and the necessary equipment for dealing with three cords of wood per day was laid down. The neighbouring saw mills provide the raw material which is water borne to the distillery. As it is landed it is packed into cans, which, according to the statement of the engineer in charge of the work, are wheeled into the plant, picked up by an overhead crane, and dropped into a brick retort, one of several, which are placed together in order to avoid radiation. The top of the can forms a flange which fits into a groove around the top of the retort. This groove is filled with tar and forms a gas seal. Electricity at 110 volts is carried through wrought-iron strips threaded through the brickwork on each side of each retort. The current supply for each retort is controlled by an ordinary switchboard which carries direct-reading pyrometers, which register the temperature outside the can and also at the centre, thus showing the maximum and minimum temperature conditions.

It is pointed out by the engineer that flexible connections are provided to the pyrometers, and they can thus be changed as desired from can to can. Describing the action which takes place, he mentions that the turpentine vapour is taken from the retort through a removable copper pipe leading to a condenser, consisting of an upright copper pipe, down which a spray of water is passed through the ascending turpentine vapour, and which terminates in a tank at the bottom. This serves as a separator for the condensed turpentine and

water, the turpentine floating on the surface. The excess of water is withdrawn from the bottom of the tank, and the turpentine is conducted to a storage system.

When a can is inserted, the temperature of the brickwork is about 250° C. Heat is rapidly absorbed, and the temperature is maintained by a current of 400 amperes, which is passed through for about two hours. When the temperature of the outside of the can has reached 150° C., and the middle of the can about 205° C., the turpentine has been substantially removed. In the process the pitch runs off, and is collected in the bottom of the retorts. The greater heat in the middle of the can is due to the decomposition of hydro-carbons in the wood.

At this stage the can is lifted and placed in the adjoining retort, and its place is filled by another canful of raw wood. The can from which the turpentine has been removed is then connected to another condenser, the temperature rises steadily without further application of electricity, and the decomposition gives off a product known commercially as tar oil.

Another important by-product is wood tar, which can be used for a variety of purposes. This drains down to the bottom of the retort, and is drawn off at frequent and regular intervals. The process is continued for three hours, at the end of which time the can is removed and allowed to cool on a sand floor, making an air seal. At this stage the contents of the can consist of charcoal. After this has been cooled, without being allowed to come into contact with the air, it is found to be of a specially tough and close-grained character. The by-products per 1,000 lb. of wood are said to be approximately :—Turpentine, 6·7 gallons; resin, 168 lb.; tar oil, 5·1 gallons; tar, 68 lb.; and charcoal, 323 lb. It is interesting to note that the treatment of each can requires about 90 KW.-hours.

A COMMERCIAL CRITERION OF GAS AND OIL ENGINE PERFORMANCE.

A FURTHER example of the strenuous efforts made by the gas industry to delay the rapid progress of the electric motor is to be found in the action of the Gas Light and Coke Co. and the South Metropolitan Gas Co., who have borne the whole cost of an expert survey, conducted during the last two years, to ensure that their consumers should get the best possible results from their engines and at minimum expense. Up to the present time, close upon 800 engines have been inspected, tested and reported upon by Mr. W. A. Tookey, who explained (in an interesting paper read before the Institution of Mechanical Engineers) the means whereby he had been able to improve the working of 66 per cent. of all the engines tested and to such an extent that, by simple running adjustments alone, the average increase effected in power per impulse was 27 per cent., while the average reduction in gas consumption per I.H.P.-hour was 13·3 per cent. The success of the measures adopted and the fact that they were applied without deranging the normal operation of the engines concerned, make Mr. Tookey's results of interest to every owner or operator of internal-combustion engines of any kind, whether use to drive workshop shafting or an electric generator. The essential stages in the inspection and tests are as follows: At a preliminary inspection, the size, type and make of engine are noted; its mechanical details and conditions are examined; and its valve settings are checked. Indicator cards are then taken on light and normal loads with the engine "as found." From the previous checking of the valve settings and the information afforded by "load as found" and "light spring" cards, it is possible to decide which, if any, adjustments are required to improve the performance of the engine.

Throughout the above extensive series of commercial tests the mixture strength of charges has been computed in terms of total cylinder contents (gas, air and residuals), expressed in B.TH.U. per cubic foot, and divided into the mean positive-loop pressure calculated from indicator diagrams. The quotient (mean pressure/mixture strength) thus obtained has been an invaluable aid in deciding what steps to take to improve engine performance. It is easy, by theoretical considerations, to justify this factor as a criterion of thermal economy, and to justify the statement that if Tookey's factor lies between 2·3 and 2·4 lb. per square inch mean pressure for each B.TH.U. calorific value in 1 cb. ft. of cylinder mixture, the engine concerned is doing well, and can seldom be improved in economy under ordinary working conditions by adjustment. Fully-illustrated instructions for the determination and application of the new factor are to be found in Mr. Tookey's paper. The simplicity of this criterion, and the fact that it is applicable to every type and size of internal-combustion engine, make it particularly useful for test-bed and running-test purposes.

A further important conclusion to be drawn from this unique series of trials is that mixtures worth 50 or 55 B.TH.U. per cubic foot of effective cylinder volume can be burnt efficiently in gas engine cylinders, so that, given close adjustment of ignition timing, pressures of 90 lb. or more per sq. in. can be used without risk of preignition, provided the compression pressure is not too high, and the cooling adequate. From this it follows that engines rated on 80 lb. m.e.p. possess a capacity for overload far greater than is generally conceded to them, but to realise this overload capacity it is essential that means of control of ignition and mixture combustion be provided by makers. Ignition tubes, with timing valves, must be abandoned in favour of adjustable electric ignition. To maintain maximum efficiency, indicator cards should be taken at frequent intervals while noting the fuel consumption, and thence determining the value of "Tookey's factor."

A significant deduction can also be drawn from the survey. Of these 800 engines, two-thirds were running inefficiently; the average improvement effected by the adjustments made was over 13 per cent., and in some cases the owners were recommended to have the engines repaired in addition. It is evident, therefore, that the gas engine needs expert supervision if it is to be kept in good order; and what applies to two-thirds of the London engines no doubt applies equally to all the industrial gas engines in the country.

NOTES.

(*Continued from page* 228.)

Refreshments at Electricity Works Inspections.—At a recent meeting of the Aberdeen Town Council, Mr. Walker objected to refreshments being provided at the electricity works on the occasion of the annual inspection, remarking:—"We can go down there and visit the electrical department without the assistance of anything, spirituous or otherwise." Mr. Stewart Thomson said the visitation meant going a lot underground, and if provision were not made in the way suggested, they might have 1,000 volts passing through them. It was very necessary that that should be prevented.

Annual Social.—The staff of the General Electric Co., Ltd., Newcastle branch, held their annual whist drive and dance on January 30th, at the Masonic Hall, Shields Road, Newcastle. The company, numbering approximately 160, spent a very pleasant evening, dancing being kept up to 1 a.m. The whist prizes were distributed by Mrs. J. Spence.

International Rubber Congress. — At the International Rubber Exhibitions of 1908 and 1911 papers were read by planters, chemists and manufacturers on everything connected with the production of rubber, and discussions followed that brought to bear the experience of experts from every rubber-growing country in the world. Those papers and discussions were fully reported and reproduced in two books that form valuable works of reference on every question connected with the industry, in which is engaged many millions of British capital.

As the fourth Rubber Exhibition and International Rubber Congress opens on June 24th, the President, Mr. H. A. Blake, requests that any person who desires to read a paper on any subject connected with the growing, curing or manufacture of rubber, or the possible expansion of its uses, or to take part in the discussions, will kindly communicate as early as possible with the Honorary Secretaries of the International Rubber Congress, Exhibition Offices, 75, Chancery Lane, London, W.C.

Continuity of Supply.—Too late for our "Correspondence" columns, the following letter has come to hand:—

"I regret to note that you have published an anonymous communication as to the rates of wages paid by the Yorkshire Electric Power Co. without first ascertaining whether there was any truth in the statement. The rates paid by the Yorkshire Co. are as set out in the statement enclosed for your private information. I think you will have no hesitation in agreeing that the statement made by your anonymous correspondent has no foundation so far as the Yorkshire Power Co. is concerned.

"W. B. WOODHOUSE, *Engineer.*

"Dewsbury, *February 4th*, 1913."

[The rates mentioned in the statement referred to are certainly not open to criticism.]

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials—At the Birmingham City Council on Tuesday the Electric Supply Committee recommended that the salary of MR. R. A. CHATTOCK, the city electrical engineer, be increased from £1,200 to £1,500. Mr. Ellaway referred to the

growth of the undertaking and Mr. Chattock's duties and responsibilities since he received his last increase in June, 1907; he also quoted figures regarding salaries in the Glasgow, Liverpool and Manchester electric supply departments to show that the proposal was not unreasonable. An amendment was moved by Mr. M. L. Lancaster referring the matter back to the Committee for further consideration, the speaker remarking that an increase of 25 per cent. at one step was extraordinary, and adding that the contribution to the rates from the undertaking was not at all commensurate with the capital expenditure. Mr. Stephenson moved a further amendment making the increase to £1,400. He remarked that Mr. Chattock was well worth £1,500, but he asked the Committee to accept his amendment because it was more likely to be carried than the original resolution. Mr. Ellaway having intimated his acceptance of Mr. Stephenson's amendment, it was carried by 57 votes to 35.

Mr. L. H. Cumberland, charge engineer at the Dewsbury Corporation electricity works, has resigned his position.

The Exeter City Council has increased the salary of the electrical engineer, Mr. H. D. Munro, to £475.

Mr. Harry Hoggart, installation inspector in the electricity department of the Blackpool Corporation, has accepted a post in the testing department of the South Lancashire Power Supply Co. Last week his colleagues at Blackpool presented him with a gold watch, a fountain pen, and a pocket wallet. Mr. W. W. Parkinson, works superintendent, handed him the gifts.

At Leeds on January 28th, Mr. Barnett Pasacovitch, senior engineer-in-charge at Nuneaton electricity works, was married to Miss Jane Cohen. The presents included a set of silver tea knives from the works technical staff, and a silver rose bowl and other useful articles from his colleagues.

Mr. A. J. Wray, who for the past 10 years has been managing engineer of the Banbury and District Electric Supply Co., has been appointed managing engineer of the Kidderminster and District Electric Lighting and Traction Co. Mr. G. D. Vickers, assistant engineer of the Birmingham and District Power and Traction Co., Ltd. (Shropshire, Worcester, and Staffordshire Power Supply Co.), has been appointed managing engineer of the Banbury and District Electric Supply Co., Ltd.

On the amalgamation of Heaton Norris with the borough, the Stockport T.C. is to be recommended to increase the salaries of chief officials and fix maximum salaries for each position. It is proposed to increase the salary of the electrical engineer from £500 to £600 by two advances of £50 each; and to increase the salary of the tramways manager from £300 to £350.

Mr. T. A. Taylor, mains superintendent of the Hammersmith B.C. electricity undertaking since 1909, has resigned his appointment, having obtained a similar position with the Sunderland Corporation electricity department.

Mr. C. W. Coppinger, shift engineer, and Mr. A. E. Ricketts, sub-station superintendent, at the Poplar electricity works, are to be placed on the staff in Class 5 at salaries of £150, rising by annual increments of £12 10s. to £185 per annum.

Subject to the usual sanction, the following increases are to be made in the salaries of the undermentioned employés at the Eccles electricity works:—W. Ashton, mains foreman, £2 12s. 6d. to £2 15s.; A. M. Mulliner, assistant electrical engineer, £150 to £160 per annum; E. J. Gilbert, station superintendent, £2 15s. to £2 17s. 6d.; C. J. Walker, switchboard attendant, £1 to £1 2s. 6d. at the end of a year's service. It is also proposed to advance the wages of switchboard attendants by annual increments at the rate of 2s. 6d. per week to £1 5s. per week, subject to the satisfactory performance of their duties.

At a meeting of the Salford T.C., on the 4th inst., the resignation of Mr. H. J. Hawkins, borough electrical engineer, was announced from May next, and the Committee recommended that applications for the vacant position be invited at a salary of £1,000 a year, and that the sale of salaries be amended accordingly. Under the present scale the maximum is £700 per annum. The recommendation was adopted by a large majority. Alderman Linsley, who supported the motion, said the present condition of the Electricity Committee was due to the cheeseparing policy adopted in the past.

The Council is recommended to increase the salaries of the three charge engineers at the electricity works from £190 to £200 per annum, and to fix a higher amount as the maximum for these positions.

Mr. Ernest E. Kell is resigning his position as repairs engineer to the St. Marylebone electric supply to take up an appointment as chief assistant electrical engineer to the Ceylon Government, and would be glad if manufacturers would forward catalogues to the Public Works Department, Colombo.

Tramway Officials.—Amongst a number of recommendations for increases of salary which are to be brought before the Manchester City Council are the following:—Mr. J. Wood, assistant manager, tramways department, from £500 to £600 per annum; Mr. D. G. Mallalieu, permanent way superintendent, tramways department, from £300 to £350 per annum. The total increases recommended amount to £3,493 per annum.

The Maidstone T.C. has on the recommendation of the Light Railways Committee, increased the salary of Mr. Lambert, tramways manager, from £200 to £250 per annum.

General.—At the offices of the A.E.G. Electric Co., Oxford Street, W., on Saturday, January 31st, Mr. T. Hammond, who has been in the employ of the firm for the last eight years as supervising erecting and contract engineer, was the recipient of the following presents:—Solid silver card case, presented by Mr. A. C. Goodman on behalf of the management and office staff; silver mounted umbrella, gent's dressing case and pigskin attaché case, presented by Mr. Parsons on behalf of the foreman, wiremen, and mates. Mr. Hammond is leaving the company to take up the management of the contract department for Messrs. Tyler Apparatus Co., Ltd., at 15, Gerrard Street, W.

Mr. Wilfrid C. Parkinson, late of the Magnetic Observatory at Eskdalemuir, and formerly of the Royal Observatory, Greenwich, who recently was appointed as Magnetic Observer under the Carnegie Institution of Washington, has been given charge of the magnetic survey of Australasia, and was to leave Washington for Perth, Western Australia, last month.—*Weekly Scotsman.*

An Aberdeen newspaper states that Mr. James Dawson, electrical engineer, who has been in charge of the electric lighting department of Messrs. John Blaikie & Sons, Ltd., for the past 16 years, has been appointed electrical engineer to the Duke of Richmond and Gordon at Gordon Castle. Mr. Dawson will also be in charge of the electric lighting of the town of Fochabers.

Councillor J. J. O'Neill has been elected chairman of the Electricity Supply Committee of the Dublin Corporation, and Alderman Farrell deputy chairman.

The University of Bristol has recently awarded Mr. Chas. F. Smith the degree of D.Sc. in the Faculty of Engineering, for research work embodied in various papers read before the Institution of Electrical Engineers, and other publications in the same region.

Mr. C. J. Jones, of the Willesden works of the British Thomson-Houston Co., Ltd., who is proceeding to take up an appointment with the company in connection with the electrification of the Argentine Railways, has been presented by his colleagues with a watch and case of pipes.

At the annual meeting of the Dee Conservancy Board, the acting conservator, Mr. Caradoc Williams, received a presentation in recognition of his work in successfully carrying out the scheme of lighting the Dee estuary by electricity. Mr. Kenneth Young-Husband, the electrician of the works, was similarly recognised.

Mr. Fiennes O. Trotman, after 7½ years' service as mains and distribution supervisor in the electrical engineers' department of H.M. Dockyard, Devonport, has tendered his resignation, he having accepted an appointment as engineer on the contract staff of Messrs. W. T. Henley's Telegraph Works Co., Ltd.

Obituary.—Mr. W. J. Williams.—The death took place on January 26th, from pneumonia, after a short illness, of Mr. Walter John Williams, partner in the firm of H. R. Williams and Co., electrical engineers and contractors, High Street, Barnstaple. Deceased, who was only 37 years of age, had, with his brother, Mr. H. H. Williams, had control of the business for the past 15 years.

Mr. R. C. C. Yates, electrical engineer with the Southern Mahratta Railway Co. in India, was thrown from his horse and killed on February 1st. Mr. Yates, who was 30 years of age, had been in India five years.

Wills.—The *Times* states that Mr. John Walker Wilkins, of Kingston, civil and electrical engineer, who in the forties succeeded in sending electric signals without wires, left estate valued at £113 gross.

According to the *Financial Times* the late Mr. A. S. Giles, general manager of the Lisbon electric tramways, left £7,523 gross and £7,343 net personalty.

PASSING-OFF ACTIONS.

[BY OUR LEGAL CONTRIBUTOR.]

It frequently happens that those who are new to any particular trade try to get business by an attempt to catch a little of the popularity of their trade rivals. Goods which are popular with the public are often sold under a distinctive title, and an attempt is made to copy that title without infringing the law. Nor is the adoption of a title which is a colourable imitation of that used by a rival the only device resorted to. The "get-up" of goods may be imitated in a manner calculated to deceive the unwary.

The fact that there are numerous reported cases on this question seems to show that these attempts are frequently made, and that persons whose goods have acquired a genuine reputation are not always fully alive to the extent to which the law will give them protection. It is proposed, therefore, to set forth the elementary rules on the subject, using the case of Thorn *v.* Eugen Sandow which was decided some time ago, as a kind of preliminary example. The facts there were very simple. The plaintiffs had for many years sold cocoa in tins, bearing the label "Health Cocoa." There was evidence that these words had acquired a secondary meaning, and were known in the wholesale and retail trade to be distinctive of the plaintiffs' cocoa. The defendants recently commenced the manufacture and sale of cocoa in London, not knowing of the plaintiffs' business, and placing on their labels the words "Health

and Strength." The plaintiffs sued accordingly for damages for infringement of trade mark and for passing off. The defendants counterclaimed for the amendment of the register of trade marks by expunging the word "Health" as applied to the defendants' cocoa, on the ground that, being a descriptive word, it was not capable of registration.

Mr. Justice Neville came to the conclusion that the words "Health and Strength" were calculated to inform the public that they were dealing with Sandow (Ltd.); that no person would be deceived into thinking it was the plaintiffs' cocoa. Consequently, he refused to grant an injunction or to give the plaintiffs any relief. On the other hand, he came to the conclusion that the word "Health" as applied to cocoa could not form part of a valid trade mark, and ordered the register to be amended accordingly.

Numerous illustrations may be given of what has and what has not been held to be a resemblance calculated to deceive. In one case (Parsons & Co. *v.* Gillespie & Co. (1898) A.C. 239) Parsons and Co., of Sydney, in 1890 began to sell and continued to sell a preparation of oats as "flaked oatmeal," and registered a trade mark in New South Wales containing these words, which they claimed to be the designation of their goods in the market. Gillespie & Co., in 1894, applied to register in New South Wales a trade mark containing the words "flaked oatmeal," but were refused in consequence of Parsons & Co.'s registration. They then put upon the market a preparation of oats under the title of "G's flaked oatmeal." Parsons & Co. commenced a suit against them to restrain them from selling any preparation, not being the plaintiffs, as "flaked oatmeal." The get-up of the plaintiffs' packets and the defendants' packets were very different, and the defendant's name appeared in large letters on their packets. It was held, at the trial, that the defendants had sufficiently distinguished their preparation from the plaintiffs' so that it was not calculated to deceive the public; and the suit was dismissed, with costs.

The plaintiffs appealed, when it was held that they had not proved that the term "flaked oatmeal" was identified with the plaintiffs' manufacture, and that the defendants had done no more than they had a right to do in taking appropriate words of ordinary description to indicate their preparation, and that their acts were not calculated to pass off their manufacture as that of the plaintiffs, and it was not proved in point of fact to have done so.

The true principle was thus laid down in the Court of Appeal in the case of Payton & Co., Ltd., *v.* Titus Ward & Co., Ltd. (1900), 17 R.P.C. "When the plaintiffs' getting up of goods consists of two really different things combined, namely, a get up common to the trade, and a distinctive feature affixed or added to the common features, what has to be considered is not whether the defendants' get up is like the plaintiffs' as regards the common features, but whether that which specially distinguishes the plaintiffs' has been taken by the defendant. A defendant may take it more or less. It is very seldom that he copies it. Of course he does not do that, but if he so nearly takes it, that when you look at it as a whole you can say that the defendants' goods are calculated to be taken for the plaintiffs' goods when properly looked at—if you can say that—then the plaintiff is entitled to succeed. But if you cannot say that, and if the resemblance consists only in that which is common to the trade, to hold that the plaintiff is entitled to succeed would give a monopoly of the common features."

It has been held, however, that a person copying the attractive features of newspaper advertisements of his rival (such advertisements not being registered as copyright or as designs) does not thereby injure any property of that rival, and incurs no legal liability. This decision was arrived at in a case where the defendant had copied an advertisement consisting of stereotyped letterpress surrounded by pictures of objects which were offered as premiums to purchasers, slightly altering the conditions applicable to such premiums and substituting his own firm's name for that of the original advertiser (Wertheimer *v.* Stewart (1906) 23 R.P.C. 481).

Let us deduce a few principles from these cases which may be of use in connection with electrical goods. Suppose a firm established a reputation for a particular kind of electric lamp called the "Minimum Consumption Lamp." Upon the authority of Sandow's case (*supra*) it is clear that the phrase "minimum consumption" could not be made the subject of a registered trade-mark because it is descriptive of the merits of the article. Nevertheless, while they could secure no monopoly of the use of the words "minimum consumption," it is clear that if, by long user, the public had become accustomed to lamps of a particular size marked with these words in letters of a particular shape, against any person imitating the shape of the lamp and printing the words in such a way as to deceive, an injunction could be obtained.

But take another case. Suppose a man were to commence to manufacture boosters and called them "X.Y.Z. boosters." Suppose, further, that he were to prevent others using these letters as applied to boosters, his attempts would fail; because he could not show that those who hunt the market for boosters, would identify him with the machines which bore the inscription "X.Y.Z."

More Electric Vehicles.—It is reported that the Arrol-Johnston Car Co., Ltd., of Dumfries and Paisley, in addition to building electric pleasure cars, are about to bring out an electric delivery van and lorry of 20 cwt. capacity.

NEW COMPANIES REGISTERED.

Etablissements Kirby, Ltd. (133,634).—This company was registered on January 29th, with a capital of £12,000 in 700 6 per cent. cumulative preference shares of £10 each, and 1,000 ordinary shares of £5 each, to acquire from Kirby, Beard & Co., Ltd., of 5, Rue Auber, Paris, certain processes, designs, &c., and to carry on the business of manufacturers of, and dealers in, motor accessories, electrical accumulators, &c., in the United Kingdom or elsewhere. The subscribers are:—A. Tebbitt, 5, Rue Auber, Paris, merchant, 165 preference and 800 ordinary shares; C. Jackson, 230, Bradford Street, Birmingham, company director, 100 preference. Private company. The number of directors is not to be less than two or more than five; the first are C. G. Beard, A. Tebbitt and A. Jackson; qualification, £100; remuneration as fixed by the company. Registered office, 230, Bradford Street, Birmingham.

Dorman & Smith, Ltd. (133,632).—This company was registered on January 29th, with a capital of £50,000, in £1 shares (15,000 preference), to take over the business of manufacturing electrical engineers, &c., carried on at Salford, Lancs., as "Dorman & Smith," and to carry on the same and the business of suppliers of electricity, &c. The subscribers (with one share each) are:—C. M. Dorman, Corrisgate, Beaufort Road, Sale, Cheshire, electrical engineer; R. A. Smith, Ambergate, Wilmslow Road, Alderley Edge, Cheshire, electrical engineer; H. G. Baggs, 18, Chambres Road, Southport, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. M. Dorman, R. A. Smith and H. G. Baggs (joint permanent managing directors, each of whom may retain office while holding £1,000 shares); the two first named are governing directors, and may retain office as such while holding £5,000 shares each. Solicitors, Payne, Galloway & Co., 28, Brazennose Street, Manchester. Registered office, Ordsal Electrical Works, Middlewood Street, Salford.

Telenews, Ltd. (133,617).—This company was registered on January 28th, with a capital of £1,100 in 500 "A" and 500 "B" shares of £1 each, and 2,000 "C" shares of 1s., to carry on the business of advertisers, advertising contractors and agents, manufacturers of, and dealers in, telewriters, telautographs, lamps, wires, cables, insulators, accumulators and other apparatus, &c., and to adopt an agreement with A. B. D. Lang, J. A. Powell, L. V. Cockell and J. M. Theobald. The subscribers are:—J. Graham, 22, Great St. Helen's, E.C., gentleman, 335 "A" shares; W. E. Stewart, 22, Great St. Helen's, E.C., East India merchant, 165 "A" shares. Private company. The number of directors is not to be less than two or more than seven; the first are A. B. D. Lang, J. A. Powell, L. V. Cockell, J. M. Theobald, J. Graham, F. English and W. E. Stewart; qualification, 10 shares; remuneration as fixed by the company. Registered office, 22, Great St. Helen's, E.C.

North British Electric Welding Co., Ltd. (133,610).—This company was registered on January 28th, with a capital of £4,000 in £1 shares, to carry on the business of fusers of metals, electrically or otherwise, for welding or repairs, metal workers, boiler makers, mechanical and electrical engineers, &c., and to adopt an agreement with L. S. Taylor and P. Hutchinson. The subscribers (with one share each) are:—L. S. Taylor, 610, Royal Liver Building, Liverpool, consulting engineer; P. Hutchinson, 610, Royal Liver Building, Liverpool, consulting engineer. Private company. The number of directors is not to be less than two or more than five; the first are L. S. Taylor and P. Hutchinson; qualification, 100 shares. Solicitors: Tyrer, Kenion, Tyrer & Simpson, 10, Cook Street, Liverpool.

Bangham & Brooke, Ltd. (133,557).—This company was registered on January 26th, with a capital of £3,000 in £1 shares, to carry on the business of dealers in metal and scrap, ironmasters, founders, smelters, shippers, shipbreakers, converters of iron and steel, engineers, electricians, suppliers and distributors of electricity, &c., and to adopt an agreement between Emma B. Bangham and E. H. Brooke. The subscribers (with one share each) are:—Mrs. E. B. Bangham, 86, Bryn Road, Swansea; E. H. Brooke, Red House, Mount Pleasant, Swansea, metal merchant. Private company. The number of directors is not to be less than two or more than three; the first are Mrs. E. B. Bangham and E. H. Brooke (both permanent); qualification, £50; remuneration as fixed by the company. Solicitor, E. Harris, 3, Fisher Street, Swansea. Registered office, Temple Buildings, Goat Street, Swansea.

Boardman & Garstang, Ltd. (133,559).—This company was registered on January 26th, with a capital of £800, in £1 shares, to carry on the business of electricians, electrical and mechanical engineers and contractors, garage keepers, suppliers of electricity for light, heat, motive power or otherwise, &c. The subscribers are:—H. Boardman, 109, Bold Street, Fleetwood, electrical engineer, 50 shares; J. M. Garstang, Westwood, Whiteside Way, Cleveleys, electrical engineer, one share; H. S. Boardman, 109, Bold Street, Fleetwood, 50 shares. Private company. The number of directors is not to be less than two or more than three; the first are H. Boardman and H. S. Boardman; qualification, £50; remuneration as fixed by the company. Solicitors, H. J. Widdows & Son, Leigh.

Ebonitis, Ltd. (133,683).—This company was registered on January 31st, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of, and contractors or agents for, the supply of hard plastic material suitable for making gramophone records (particularly the compound known as "Ebonitis"), manufacturers of records, electrical switches, and other goods, &c. The subscribers (with one share each) are:—J. E. Hough, Wakefield, Chatsworth Road, West Norwood, S.E., engineer; W. F. Robbins, 48, Denman Road, Peckham, S.E., clerk; T. Hough, 202, Upland Road, East Dulwich, S.E., engineer. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, 100 shares; secretary (*pro tem.*) W. F. Robbins. Registered office, 5, Willowbrook Grove, Camberwell, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Singapore Electric Tramways, Ltd.—A memorandum of satisfaction to the extent of £33,600 on various dates from January 16th to December 15th, 1913, of debs. dated November 30th, 1906, securing £350,000, has been filed.

Crompton & Co., Ltd.—Particulars of £100,000 debs., created by resolutions of January 30th, 1893, and November 23rd, 1894, and secured by trust deeds dated January 26th, 1895, and November 17th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, including freehold works at Chelmsford and various patents. Trustees: Ivor Bevan.

Universal Radio Syndicate, Ltd. (124,355). — Capital, £100,000 in £1 shares. Return dated October 15th, 1913. All shares taken up. 10s. per share called up. £50,000 paid. Mortgages and charges: Nil.

Stolz Electrophone Co. (1913), Ltd.—Debenture dated January 21st, 1914, to secure £171 9s. charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. Hyman, 4, Heath Drive, Hampstead.

Electrical Engineering and Equipment Co. Ltd. (115,089).—Capital, £10,000 in £1 shares. Return dated December 31st, 1913; 4,002 shares taken up, £1,002 paid. Mortgages and charges: Nil.

Fred Danks, Ltd. (122,376).—Capital, £30,000 in £1 shares. Return dated November 14th, 1913; all shares taken up; £30,000 paid. Mortgages and charges: Nil.

Varley Magnet Co., Ltd.—A memorandum of satisfaction in full, on October 1st, 1913, of debs. dated October 1st, 1913, securing £500, has been filed.

Electro-Mechanical Brake Co., Ltd.—A memorandum of satisfaction in full, on January 19th, 1914, of mortgage and further charge dated June 11th, 1908, and May 19th, 1909, securing £5,000, has been filed.

Barsi Light Railway Co., Ltd. (44,589).—Capital, £300,000, in £10 shares. Return dated November 4th, 1913. 20,000 shares taken up, £10 per share called up, £200,000 paid. Mortgages and charges: £140,000 4 per cent. deb. stock and £124,400 4 per cent. later extension debs., part of £125,000 issued (£600 having been redeemed).

Newman & Co., Ltd.—Debenture dated January 19th, 1914, to secure £250, charged on company's undertaking and property, present and future. Holder: T. C. Hamblett, Alexandra Road, Penn, Wolverhampton.

Blackpool and Garstang Electric Light Railway Co., Ltd. (62,150).—Capital, £10,000 in £5 shares. Return dated January 2nd, 1914. 861 shares taken up. £4 per share called up. £1,707 paid (including £323 received on application for further shares, not allotted), leaving £60 in arrears. Mortgages and charges: Nil.

CITY NOTES.

Yorkshire Electric Power Co.

THE directors, in their report for the year ending December 31st, 1913, state that the gross profit on the revenue account for the three years ending December 31st is as follows:—1911, £12,572; 1912, £12,710; 1913, £22,140. The net profit, after payment of mortgage interest for the same periods, is:—1911, £7,784; 1912, £7,361; 1913, £15,401. The balance brought forward from 1912 is £645, which gives a total of £16,046, and deducting the dividend paid on the preference shares to June 30th, 1913, of £3,308, leaves a disposable balance of £12,738. The directors recommend that this balance should be dealt with as follows:—Dividend for the half-year ending December 31st, 1913, at the rate of 6 per cent. per annum, on the amount paid up on the cumulative preference shares, amounting to £3,550: to general reserve fund, £5,000; carrying forward £4,188. The buildings, plant and mains of the company have been fully maintained. Considerable additions have been made to the horse-power of motors connected to the company's mains, and there has been a more than proportionate increase in the revenue during the year. The generating station at Barugh, in which waste gases from by-product coke ovens are used instead of coal, has been at work since October last; it shows a satisfactory saving, and is a valuable auxiliary to Thornhill. The generating plant, of 2,000 KW. capacity, is being supplemented by additional machinery, which will bring the total capacity of the station to 5,000 KW. The demand for the company's supply is rapidly increasing in the Barnsley coalfield, as well as in other portions of the company's area. Applications for the 6 per cent. preference shares of the company and the 5½ per cent. Waste Heat debenture stock have been continuous through the year. At the present date there remain unallotted £19,775 of the preference shares, and £6,320 of the debenture stock. In order to consolidate the capital of the company, the directors ask the shareholders to approve the further issue of £50,000 of the 6 per cent. preference shares, to be offered to the holders of the second mortgages of the company in exchange for their present holdings, any balance not so taken up being issued to the shareholders and others, and the remaining second mortgages paid off. Promises to exchange have already been received from holders of over £15,000 of these.

Smithfield Markets Electric Supply Co., Ltd.

THE directors' report for the year 1913 states that the gross profit amounts to £5,764, compared with £4,005, and the net profit to £4,237, compared with £2,425 last year. A further sum of £400 has been placed to the debenture stock redemption fund (making a total of £1,741 to the credit of this account), and £2,500 to depreciation account. The available balance, including £954 brought in from 1912, is £2,291, with which the directors propose to pay a dividend at the rate of 2½ per cent. per annum on the ordinary shares, £1,500, carrying forward £791. The new plant has been running for the greater part of the year, but it has not yet been fully paid for pending the proper fulfilment of the contract guarantees. The other plant has been efficiently maintained, and it is satisfactory to note that a further reduction in costs has been effected. The cost of the plant and machinery displaced during the year has been entirely written off from the depreciation fund. The meeting will be held on Tuesday next.

Mersey Railway Co.

THE directors report that for the year ended December 31st, 1913, the train mileage run was 547,784 miles, as compared with 561,494 for the previous 12 months. The number of passengers conveyed during the year was 13,241,615, as against 12,745,311 for the previous 12 months, exclusive of season ticket holders. The total receipts in respect of railway working for the year have been £117,330, as compared with £112,376 for the previous 12 months. The working expenses, exclusive of the charges for pumping, ventilation and lifts, have been £57,019, equal to 48·88 per cent. of the traffic receipts, as against £53,739, equal to 48·10 per cent. for the previous 12 months. These charges for pumping, ventilation and hydraulic lifts, for the past year amounted to £7,266, equal to 6·23 per cent., as compared with £7,029, or at the rate of 6·29 per cent. for the previous 12 months. Under the scheme of arrangement scheduled to the Mersey Railway Act, 1900, as extended by the Mersey Railway Acts, 1906 and 1910, the payment of interest on the following debenture stocks, viz:—1866, 1871, 1882/3/5 and B, is contingent on the revenue of the company available therefor in each separate year. The auditors have certified that the revenue available for this purpose for the year ending December 31st, 1913, amounts to £20,202, as compared with £18,061, for the previous 12 months, and this amount is accordingly being distributed to the debenture holders, as follows:—

Interest at 4 per cent. on the 1866 debenture stock					..	£4,664
,,	3	,,	,,	1871	,, ...	3,000
,,	3	,,	,,	1882/3/5	,, ...	10,800
,,	12s. 4d. per cent. on the "B" debenture stock					1,735
	Balance carried forward					2

The meeting will be held next Tuesday.

Dublin United Tramways Co., Ltd.

THE annual report states that the amount available for division this year is £88,000. Ad interim dividends amounting to £35,595 were paid last August, leaving £52,445 now available. Out of this it is recommended that a dividend of 6 per cent. (less income-tax) be paid on the preference shares for the half-year ended December 31st, 1913, and that a final dividend at the rate of 5 per cent. per annum (less tax) be paid on the ordinary shares for the half-year ended December 31st, 1913, making with the ad interim dividend already paid a dividend on the ordinary shares, for the year 1913, at the rate of 5½ per cent.; setting aside £7,000 towards renewal of permanent way, and £3,000 for renewal of cars. The revenue account shows that the total receipts during 1913 were £297,731, as against £318,831 in 1912, a reduction of £21,100. The expenses showed an increase of £2,410. The directors point out that the restricted service necessitated by the partial strike of motormen and conductors in August last, and the general disorganisation of business owing to the labour disturbances of the last four months of the year, had a serious effect on the receipts.

Torquay Tramways Co.

AS evidence of the progress of the undertaking, the following comparative statistics are given in the annual report:—

	1913.	1912.	1911.
Gross revenue ...	£33,564	£28,794	£22,949
Traffic revenue ...	32,214	28,112	22,635
Profit	15,782	11,755	8,895
Passengers carried	4,832,684	4,207,619	3,594,317
Car-miles	671,023	626,478	494,468
Average receipts per car-mile... ...	11·52d.	10·77d.	10·99d.
Ditto per passenger	1·60d.	1·60d.	1·51d.
Cost of energy per car-mile... ...	1·83d.	1·97d.	2·41d.

Deducting from the profit of £15,782, debenture interest at the rate of 5 per cent. on £118,000, and sinking fund charges for the redemption of prior lien debentures, there remains a balance of £9,182, plus £638 balance from 1912—£9,820. £2,500 is to be voted to the fund for reserve and renewals, £116 for depreciation on furniture, &c., and £126 for uniforms, and a bonus to the staff absorbs £195. Adding £6,000 for a 5 per cent. dividend on the ordinary shares (£120,000), there will remain £882 to carry forward to the current year's accounts. The undertaking has prospered since the company was able to substitute for the surface-contact system the overhead trolley system. An amount calculated roughly at £60,000 represents the cost of material left underground when the surface-contact system was superseded.

Monterey Railway Light and Power Co.—In consequence of conditions in Mexico, the directors have postponed payment of the interest on the 5 per cent. first mortgage debenture stock, due February 2nd, for the present.

South London Electric Supply Corporation, Ltd.—The directors announce a dividend on the ordinary shares for 1913 at the rate of 5½ per cent. per annum.

Continental.—France.—Among the new companies recently formed in France are the Société Electrique de l'Est, formed at Stenay (Meuse), with a capital of £6,000, to establish a central electric lighting station near that town; the Société Charentaise de Distribution Electrique (Paris, 5, Rue St. Vincent de Paul), capital £8,000; and the Compagnie Générale des Secteurs Electriques Français, capital £80,000, to establish central electricity supply stations in the Allier and Côte d'Or Departments.

The report of the last financial year of the Société des Exploitations Electriques, of Paris, shows a net profit of £17,480, as compared with £18,049 in the preceding 12 months; £16,589 is distributed to the shareholders in the form of a 5 per cent. dividend, leaving a small balance to be carried forward.

Russia.—The Gesellschaft für Elektrische Beleuchtung (1886), of St. Petersburg, is increasing its capital from £421,660 to £527,080, with the object of extending its central stations in Moscow, St. Petersburg, and Lodz.

Finland.—The Swedish A.E.G., which company up to the present time has had an important export business to Finland, at the new year, owing to the increased volume of business, formed a subsidiary company at Helsingfors under the name of the "Allmänna Elektriska Aktiebolaget, in Finland." Apart from Finland, the company have now subsidiary companies of their own in Norway, Denmark, England and Spain.

Norway.—At an extraordinary general meeting of the Norwegian Electrochemical and Metallurgical Industry, A/S, it was unanimously decided to increase the present capital, £333,333, by £66 667, to a total of £400,000. The company carries on a financial and promoting business, and there can be no doubt that its activity will be considerably extended, the more so as the capital was increased by £161,000 just before Christmas, 1913. The new issue has already been taken up privately by several banks and financiers.

Stock Exchange Notices.—The Committee has ordered the undermentioned to be quoted in the Official List:—

Commercial Cable Co.—£4,446 additional sterling 500-year 4 per cent. debenture stock.

Mississippi River Power Co.—$14,574,200 additional first mortgage 5 per cent. 40-year gold bonds, within Nos. M1 to 13,589 ($1,000), D1 to 166, 5,370 to 5,409 and 6,805 to 12,868 ($500), and C1 to 100, 2,108 to 2,197, 2,206 to 3,447 ($100).

South London Electric Supply Corporation, Ltd.—Further issue of £19,950 5 per cent. first mortgage debenture stock.

Prospectuses.—*Victoria Falls and Transvaal Power Co., Ltd.*—The list is to close to-day in a sale of £650,000—5½ per cent. second mortgage debentures, series B, at 92 per cent. There are issued £3,000,000—5 per cent. first mortgage debentures and £1,650,000—5½ per cent. second mortgage ditto, also £2,000,000 in preference shares and £1,000,000 in ordinary. The proceeds of the present issue will be used for extensions now in hand, which extensions are based on notified requirements already received from consumers. These extensions will bring up the generating capacity to 260,000 H.P., which, when in full operation, should increase the profit to £60.000 per month, on which estimate the service of the second debentures will be covered practically three times over.

Anglo-Argentine Tramways Co., Ltd.—On Monday last this company offered for subscription an issue of £1,500,000 of 5 per cent. debenture stock at 95 per cent. The issue is made to provide further capital towards the construction of the subways that have frequently been referred to in these pages, and for the general capital purposes of the company. It was announced that the list was to close on or before Friday (to-day), but as a matter of fact the list closed on Monday so far as the non-shareholding public were concerned.

Montana Power Co.—There has been offered for sale this week $10.000,000 first and refunding mortgage 5 per cent. sinking fund gold bonds 1943, at 94 per cent.

The City of Auckland, New Zealand, has been offering a 4½ per cent. electric power additional loan, to the amount of £224,500 in debentures at £100 each.

Metropolitan Railway Co.—The directors recommend a dividend on the ordinary stock for the past half-year at the rate of 1¾ per cent. per annum, carrying forward £8,200. A year ago the dividend was at the same rate. The dividend on the surplus land stock is at the rate of 2¾ per cent. per annum.

South America.—Although the total receipts in 1913 of the Société d'Electricité de Rosario only slightly exceed those of 1912, the net profits show an increase of £18,000, notwithstanding that the tramways have paid £11,000 less for energy, and that the charge for private electricity supply has been reduced by 25 per cent. The demand for energy for both lighting and power purposes shows steady progress, and consequently much better results are expected for the current year.

Japan.—The Yokohama Electric Co. reports a net profit of £43,582 for the last half-year. Of this sum £29,088 is being distributed to the shareholders in the form of an 11 per cent. dividend; £2,100 is being placed to legal reserve, £4,000 to capital sinking fund, £3,000 to dividend reserve, and £3,330 to bonuses, leaving a sum of £2,064 to be carried forward.

National Boiler and General Insurance Co., Ltd.—An interim dividend of 6s. per share is announced.

Parsons Marine Steam Turbine Co., Ltd.—An interim dividend of 6 per cent. for the half-year is announced.

South London Electric Supply Corporation, Ltd.—The directors recommend a dividend on the ordinary shares for the past year at the rate of 5½ per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

To find an adjective that shall fitly describe the condition of Stock Exchange markets, as compared with that of a month ago, might tax the vocabulary even of a professional journalist. It is beyond the power of the writer of such humdrum notes as these. Many men in the Stock Exchange call it miraculous, and certainly the swiftness of the alteration in the financial situation is outside the experience of all but the most venerable members of the House.

Money is offered freely on the security of Consols at 1¾ per cent. Day-to-day money can scarcely be lent at ½ per cent. There is no stopping the literally immense volume of money which is flowing into all the investment markets. It has but skirted the purely speculative areas, its attention being mainly confined to such stocks and shares as buyers and sellers are in the habit of paying for or delivering. Of course, a huge gambling movement has started side by side with the investment demand, so men are dealing in their 50 thousand or 100 thousand Consols with the same freedom as, in the ordinary way, they would speculate in a few hundred Kaffirs or Rhodesians. The only market of the House which has not participated in the revival is that devoted to oil shares, where interest is stagnant and the public cold.

The Electricity Supply list received a sharp fillip, by the declaration of a dividend of 12 per cent. on St. James', comparing with 10 per cent. for the previous year. This set the prophets discussing the chances of advances in other directions, and, at the same time, sent buyers flocking into the market. Most of the big London shares have risen, and the principal favourites are City Ordinary, where, of course, there is a speculative account to add stimulus to the dealings. The price of the shares rose £1 to 18, and it is hoped that last year's dividend of 9 per cent. will be followed by at least double figures. The County dividend of 6 per cent. is expected to be advanced to 7 per cent., and on the strength of this anticipation the ordinary shares rose ⅜ to 12½. Kensingtons hardened to 8, Metropolitans to 3¾, London Electric to 1 19/32, while St. James' at 9¼ are 12s. 6d. higher. Reference to the list will show that other gains have been secured, and the market as a whole is decidedly strong. The demand for Debenture stocks continues to be insatiable, and the quotations which are sent out are of chief interest to holders, because prospective buyers find that they can scarcely get hold of £5,000 stock in any one company. Fresh developments are taking place this week in connection with the coming Parliamentary session.

Crompton Debenture again soared, the price being 4 points higher at 80. General Electric Preference rose to ¼ above their par price of 10. Other manufacturing shares are good, the rises including Callender's Ordinary, Henley's Preference, British Aluminium, and others. India-Rubber shares, exceptionally, gave way 10s., but this need not worry proprietors, because there is little doubt that if the markets continue in their present temper, the reaction will soon be wiped out. Rubber itself has again touched 2s. 6d. per lb. Babcock & Wilcox spurted to 64s.; gossip declares that Mr. Winston Churchill has an eye on the Sinking Fund for a few Navy millions. Which is as events may prove it to be.

The Colonial and Foreign list of electricity issues is as strong as the rest. The principal features are rises in Mexican Light and Power descriptions; the Common shares gained 4, and the Second Mortgage bonds have been in special request, the present price of 72 being 5½ up on the week, this coming on top of their 7½ points recovery in the week previous. River Plate pre-Ordinary stocks are better. Canadian General Common went up 6½ on the recovery in all the stocks and shares connected with the Dominion. The suspicion which recently overhung most things Canadian is in full flight, and the public are buying such issues as freely as other stocks and shares. Victoria Falls Preference braced up to 17s. Calcuttas are better, both as regards Ordinary and Preference.

The Home Railway market reflects the alteration in the mind of the investor. The reduction of the Bank Rate to 3 per cent. last Thursday, with the accompanying lowering of deposit rates to 1½ per cent., quickened the pace at which the tide of capital poured into the markets. The declarations of several good dividends cheered holders of the ordinary stocks, and the whole catalogue shows substantial rises as compared with a week ago. The Undergrounds have shared in the strength. Districts particularly have been in favour, but Metropolitans advanced, and the Underground Electric Railways bonds are all better. To-day (Tuesday) a trifling setback occurred, though it was insignificant in extent.

One of the features in the Traction department has been sharp rises in British Electric Traction stocks, the whole sextet advancing from 1 to 6 points. Rumour circulated the idea that the company is doing sufficiently well to pay, at any rate 5 per cent. on the Non-cumulative Preferred stock, which for 1912 received 3 per cent. Upon this, the price rose 6 points, while the company's Second Debenture stock went up 3. The 6 per cent. preferred at 17 is 2 higher, and the Deferred at 8 shows a rise of 2½. London and Suburban First Debenture stock advanced 5. London United Tramways Debenture retained its previous rise at 66. In the prior-charge stocks there are many gains, District 4½ per cent. First Preference, for instance, putting on 8 points at 91. Metropolitan Electric Tramways Debenture rose 4, and Central London Assented stocks have again hardened.

The Anglo-Argentine Tramways Company has been offering—at 95—the balance of its 5 per cent. Debenture stock. For this there was a rush, and the lucky underwriters, who received 1½ per cent. commission, were able to sell firm stock at a premium before the allotments were out. The stock is certainly cheap enough at anything like 96, and will probably improve to the neighbourhood of par. The company's Preference shares are $\frac{1}{16}$ better in both cases. British Columbia Electric Deferred followed up its 12 points gain with another rise of 1½, and Calcutta Trams improved to 5½.

The Mexico Tramways group developed fresh strength, last week's big rises failing to arrest the buyers, who insisted upon having stock, and who took up the prices from 1 to 3 points. Rio bonds are better, the Seconds being 1½ higher at 97; and other securities in the same group displayed robust strength. Monterey Debenture was unaffected by postponement of the interest payments.

Whereas, a little while ago, new issues were regarded askance, and the cry went up that underwriters ought to make a ring with the purpose of boycotting them, the present conditions make Stock Exchange jobbers not only willing, but eager, to take fresh offerings of stock. The ease of the money market is the pivot upon which the whole situation turns. The authorities tell us that this may not merely be maintained, but may be accentuated by another fall in the Bank Rate; so that although a bull account has certainly been built up, even in investment markets, the buoyancy of money is relied upon to justify the buyers in holding their stock. New issues have to be advertised for a very short time before the lists are closed in sound, cheap stock. The new Melbourne Electric Debenture can be sold at 2½ premium.

The Telegraph rises of last week make futher progress, and it will be seen that there is a long string of advances to the credit of this market. The principal feature has been excited buying of Anglo-American Telegraphs, the Deferred stock swiftly jumping 1⅜ to 25½, while the Preferred put on 2¾. Direct United States rose 10s., and other Anglo-Americans were also good, the only dulness in this section being in American Telephone and Telegraph stocks, which were offered from the other side of the water. South American stocks and shares of all kinds found ready buyers, and the Brazilian position, for some reason or other, is declared to have altered for the better, just as the Mexican situation, which to the ordinary man might appear to be much the same as it was a month ago, no longer troubles the sleep of either speculator or investor.

The Eastern group improved with the rest; Indo-Europeans, Western Telegraphs, West India and Panama are all better. The Trust group is also firm, with Globe Preference ¼ up at 12¾. There has been substantial buying of Marconis, which took the price to $4\frac{1}{16}$, from which it sagged slightly as profit-takers came in to sell. Marconi Marines have been in demand at 35s., upon anticipation that last year's dividend of 10 per cent. will be improved upon when the accounts for the current year are published. The markets all round are good; the important City failure at the beginning of the week had little effect, and in the price-lists overleaf it may be noticed that there are some 140 rises to about half-a-dozen falls.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Jan. 28	2,671	— 229	4	2,671	— 229	..	..
Blackpool-Fleetw'd	„ 31	1,203	+ 28	4	1,203	+ 28	8	..
Bristol	„ 30	28,868	+1,568	5	31,190	+ 679	30·5	..
Brit. Elec. Trac. Co.	„ 28	193,182	+ 729	..	..	..	459·8	1·25
Chatham and Dist.	„ 29	3,206	— 898	4	3,206	— 893	14·98	..
Cork	„ 29	1,776	— 100	4	1,776	— 100	9·89	..
Dublin	„ 30	20,150	—1,930	5	21,646	— 2,157	54·25	..
Hastings	„ 28	2,685	— 300	4	2,685	— 300	19·3	..
Lancashire United	„ 28	6,058	+ 765	4	6,058	+ 765	42	3
Llandudno-Col. Bay	„ 23	601	+ 3	3	1,168	— 7	6·5	..
London United ..	„ 30	20,768	— 490	5	22,944	— 670	..	..
Tyneside	„ 31	1,782	+ 72	4	1,782	+ 72	11	..
Anglo-Argentine ..	„ 28	227,911	+8,741	4	227,911	+ 8,741	..	..
Auckland	„ 16	25,638	+3,980	28	135,588	— 3,874	25·42	1·31
Brisbane	Nov.	27,058	+2,743	..	287,071	+58,650	..	..
Calcutta	Jan. 31	18,238	+ 574	5	..	+ 677	..	..
Kalgoorlie, W.A. ..	Dec.	2,907	..	52	84,510	..	20·5	..
Madras	Jan. 31	3,876	+ 334	4	3,876	+ 334	15·25	..
Montevideo ..	Jan.	88,256	+ 195	13	102,095	— 72	..	..
Cen. London Rly.	Jan. 31	21,108	—1,357	5	26,347	— 1,713	6·78	·4
City & S. Lon. Rly.	„ 31	11,576	— 855	5	14,682	— 908	7·26	..
Dublin-Lucan Rly.	„ 30	467	— 38	4	467	— 38	7	..
L'pool Overh'd Rly.	Feb. 1	6,695	+ 287	5	8,408	+ 320	6·6	..
London Elec. Ry. Co.	Jan. 31	59,005	—1,045	5	74,190	— 670	21·25	..
Mersey Railway ..	„ 31	9,043	+ 88	5	11,829	+ 10	4·6	..
Metropolitan Rly.	„ 25	73,110	+6,2 0	4	73,170	+ 6,200	29·25	3·5
Met. District Rly.	„ 31	52,603	— 892	5	65,949	— 776	25	..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	3d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£30 10	..
a Bleaching powder	„	£6 5	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	..
a Copper Sulphate	„	£22 10	..
a Lead, Nitrate	„	£30 10	£1 inc.
a „ White Sugar	„	£28	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %) ..	per ton	£23 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	82/-	7/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£8 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %) ..	„	£10 5	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£86	£4 dec.
b „ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	£4 13 4 dec.
b „ Sheet, in ton lots ..	„	£112	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅜d.	¼d. inc.
c „ Tube (brazed)	„	9½d.	¼d. inc.
c „ „ (solid drawn) ..	„	8¾d.	¼d. inc.
c „ Wire, basis	„	7⅜d.	¼d. inc.
c Copper Tubes (brazed)	„	10½d.	..
c „ „ (solid drawn) ..	„	10½d.	..
g „ Bars (best selected) ..	per ton	£88	£2 inc.
g „ Sheet	„	£93	£2 inc.
g „ Rod	„	£93	£2 inc.
d „ (Electrolytic) Bars ..	„	£68 10	£2 inc.
d „ „ Sheets ..	„	£86 10	£2 inc.
d „ „ Rods ..	„	£74	£2 inc.
d „ „ H.C. Wire	per lb.	8¾d.	..
f Ebonite Rod	„	4/6	..
f „ Sheet	„	4/-	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/-	..
h India-rubber, Para fine	„	3/1½	½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	51,5	8½d. inc.
„ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£20 10	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 10	..
e Mica (in original cases) small ..	per lb.	6d. to 8s.	..
e „ „ „ medium	„	5/6 to 6/-	..
e „ „ „ large ..	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/8 to 4/6 nom	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/0½ to 1/2	..
p „ „ rolled strip & sheet	„	1/2½ to 1/5½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	½d. inc.
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£188 to £189	£14 inc.
n „ Wire, Nos. 1 to 16	per lb.	2/5	..
p White Anti-friction Metals ..	per ton	£44 to £194	..
k Zinc, Sh's (Vieille Montagne bnd.)	*ls*	£25 12 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Blackpool and Fleetwood Tramroad Co.—According to the *Financier*, the directors have declared a dividend of 4½ per cent. and 2 per cent. bonus for the year, in addition to the interim dividend of 2 per cent. already paid. This makes a total dividend of 8½ per cent. £5,000 has been placed to depreciation reserve, and £2,500 to the general reserve.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors recommend a balance dividend of 1s. 3d. per share, making 5 per cent. per annum, for the year to December 31st. £5,000 is to be transferred to general amortisation fund.

Walter Scott, Ltd.—An interim dividend on the ordinary shares at the rate of 5 per cent per annum for the half-year ended December last is announced

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for * 1912.	Dividends for * 1913.	Closing Quotations Feb. 3rd.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	⅞ — 1	..	Nil
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	16 — 18	+2	..
Do. Do. Deferred	100	..	..	7 — 9	+2½	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	93 — 96	+4	6 5 0
Do. 7 % Non-Cum. Pr'f.	100	8	..	58 — 61	+6	4 18 4
Do. 5 % Perp. Deb.	100	5	5	93 — 96	+1	5 4 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 82	+3	5 9 9
Central London Railway, Ord.	100	3	3	59 — 64	..	4 13 9
Do. Gtd. Assented	100	..	4	84 — 86	+1	4 13 0
Do. Pref.	100	4	4	70 — 75	..	5 6 8
Do. Gtd. Assented	100	..	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	60 — 65	..	3 1 7
Do. Gtd. Assented	100	..	4	83 — 85	+2	4 14 2
Do. 4 % Deb.	100	4	4	97 — 99	+2	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	96 — 98	..	5 2 0
Do. Do. 1896	100	5	5	96 — 98	..	5 2 0
Do. Do. 1901	100	5	5	95 — 97	..	5 3 1
Do. Do. 1903	100	5	5	93 — 95	..	5 5 0
Do. 4 % Deb.	100	4	4	88 — 90	..	4 9 0
Hastings Trams, 6 % Pref.	1	6	6†	½ — ¾	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	66 — 71	..	6 6 9
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76	..	5 5 3
Lancashire United, 5 % Deb.	100	5	5	81 — 83	+1	6 0 6
London and Suburban, Ord.	1	..	..	⅛ — ⅜	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	⅜ — ½	..	..
Do. Do. 4½ % 1st Deb.	100	4½	4½	77 — 82	+5	5 9 9
London Elec. Railways, 4 % Deb.	100	4	4	89 — 91	..	4 7 11
London United Trams, 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Metropolitan Railway Consol.	100	1⅝	1¼†	46¼ — 46¾	+ ¼	3 9 9
Do. Surplus Lands	100	2½	2¾†	64 — 66	+4	4 3 4
Do. 3½ % Deb.	100	3½	3½	86 — 88	+2	3 19 7
Do. 3½ % Pref.	100	3½	3½	83 — 85	+2	4 2 4
Do. 3½ % Con. Pref.	100	3½	3½	81 — 83	+3	4 4 4
Metropolitan District Ord.	100	Nil	..	33 — 33½	+1½	Nil
Do. 6 % Deb.	100	6	6	138 —141	+3	4 5 1
Do. 4 % Deb.	100	4	4	93 — 95	+2	4 4 3
Do. 4 % Prior Lien	100	4	4	94 — 96	..	4 3 4
Do. 4½ % First Pref.	100	4½	4½	90 — 92	+8	4 17 10
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 11 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	84 — 88	+4	5 2 2
Do. 5 % Deb.	100	5	5	88 — 91	+2	5 10 0
Potteries, Ord.	1	3½	..	⅜ — ½	..	..
Do. 5 % Pref.	1	5	5	⅞ — 1	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3 6
South Metro. Trams, 6 % Pref.	1	6	6†	¾ — ⅞	..	8 0 0
Do. 4 % Deb.	100	4	4	66 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	8⅜ — 9⅛	..	Nil
Do. "A"	1/-	..	..	⅛ — ⅜	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	116 —118	+1	5 1 7
Do. 4½ % Bonds	100	4½	4½	99 —101	+1	4 9 0
Do. 6 % Income	100	6	6	95½ — 96½	+2	6 4 4
Yorkshire (West Riding). Ord.	5	Nil	..	⅛ — ⅜	..	Nil
Do. 6 % Pref.	5	3	4	3⅞ — 4¼	..	4 14 3
Do. 4½ % Deb.	100	4½	4½	80 — 85	+1	5 6 0

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	+⅛	5 7 5
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	+⅛	5 19 0
Do. 4 % Deb.	100	4	4	91⅜ — 93⅜	+1	4 5 7
Do. 4½ % Deb.	100	4½	4½	96⅛ — 98⅛	+2½	4 11 5
Do. 5 % Deb.	100	5	5	96⅛ — 98⅛	— ⅛	5 1 6
Auckland Trams, 5 % Deb.	100	5	5	103 —106	+1	4 14 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11½ xd	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	94 — 96	+ ⅛	4 13 9
Do. 5 % 2nd Deb.	100	5	5	98 —100	+1	5 0 0
Brazilian Traction, Light and Power	$100	6	6†	92½ — 94½	+2	6 7 0
Brisbane Trams Invt., Ord.	5	8	8	7⅝ — 8½	..	4 18 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 13 0
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	119 —128	+1½	6 10 2
Do. Pref. Ord.	100	6	6	106 —110 xd	+3	5 9 1
Do. 5 % Pref.	100	5	5	102½ —105½	+ ⅛	4 14 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 1
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	93½ — 96½	+ ⅛	4 8 1
Calcutta Trams, Ord.	5	7½	5†	6 — 6¼	..	5 15 5
Do. 5 % Pref.	5	5	5	5 — 5¼	+⅛	4 15 3
Do. 4½ % Deb.	100	4½	4½	96 — 99	..	4 11 0
Cape Electric Trams	1	5	5	⅝ — ¾	..	6 13 4
City Buenos Aires Trams (1904)	5	5†	5	5⅛ — 5⅛	..	4 0 0
Do. 4 % Deb.	100	4	4	91 — 96	..	4 3 4
Colombo Elec. Tr. Lt., 5 % Deb.	100	5	5	89 — 93	..	5 7 8
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie Elec. Trams	1	Nil	..	0 — 1/16	..	Nil
Do. 5 % A Deb.	100	5	5	85 — 90	..	5 11 1
Do. 6 % B Deb.	100	3	..	10 — 30	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	⅜ — ½	..	..
Do. Pref.	1	4½d.	6	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	..	4 7 3
Do. 6 % Pref.	1	6	6	1⅜ — 1⅝	..	5 1 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 4 2
Madras Elec. Tr., 6 % Cum. Pref.	5	6	6	4⅞ — 5⅛	..	5 14 3
,, Elec. Tr. (1904), Deb.	100	5	5	101 —103	+2	4 17 0
Manaos Trams & Lt., 1st Deb.	100	5	5	79 — 82	..	6 2 0
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	+2	4 19 6
Mexico Trams Com	$100	7	7	76 — 79	+3	..
Do. Gen. Con. 5 % Bonds	..	5	5	86 — 90	+2	5 11 1
Do. 6 % Bonds	100	6	6	85 — 89	+1½	6 14 10
Para Elec. Rlys. & Lt., Ord.	5	10	10†	5⅛ — 5⅜	+ ⅛	8 18 0
Do. 6 % Pref.	5	6	6	4⅞ — 5	+ ⅛	6 0 0
Do. 5 % 1st Deb.	100	5	5	93½ — 95½	..	5 4 6
Perth (W.A.) Elec. Tr., Ord.	1	5½	..	1⅛ — 1⅜	..	4 0 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 4½ % 1st Deb.	100	4½	4½	95 — 97	+ ⅛	4 12 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —103	+ ⅛	4 17 0
Do. 5 % Mort. Bonds	100	5	5	96 — 98	+1⅛	5 2 0
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	100 —103	+2	4 17 0
Singapore Trams, 5 % Deb.	100	5	5	87 — 91	..	5 10 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	98 —100 xd	+2½	5 0 0
Un. Elec. Trams Monte Video	5	7	7	4¼ — 5	+ ⅛	7 0 0
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 14 3
Do. 5 % 1st Deb.	100	5	5	94 — 97	..	5 8 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	95 — 97	..	4 12 9

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	5†	9 — 10	..	6 0 0
Do. 4½ % Pref.	10	4½	4½	88 — 93	+ ¼	4 13 6
Do. Second 6 % Pref.	10	6	6	10 — 10⅜	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96	..	4 13 9
Brompton & Kensington, Ord.	5	10	9†	9⅛ — 9⅜	+ ⅛	5 4 0
Do. 7 % Cum. Pref.	5	7	7	8⅞ — 9⅛	+ ⅛	3 16 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	90 — 93	..	4 6 0
Charing Cross, West End & City	5	5	5†	4¾ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	+ ⅛	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 — 4½	+ ¼	5 0 0
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	+ ½	4 6 6
Chelsea, Ord.	5	5	4†	5 — 5⅛	+ ⅛	4 11 0
Do. 4½ % Deb.	Stock	4½	4½	97 — 100	+ ½	4 10 0
City of London, Ord.	10	9	6†	17½ — 18½	+ 1	4 17 3
Do. 6 % Cum. Pref.	10	6	6	13½ — 14½	+ ½	4 4 3
Do. 5 % Deb.	Stock	5	5	116 — 120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	99 — 102	+1	4 8 1
County of London, Ord.	10	6	5†	12½ — 12⅝	+ ⅛	4 14 1
Do. 6 % Pref.	10	6	6	11⅞ — 12½	+ ⅛	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101½ — 103½	..	4 7 0
Do. 4½ % Second Deb.	Stock	4½	4½	99 — 102	+1	4 8 1
Edmundson's, Ord.	£3	..	..	⅜ — ⅝	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4⅜	..	7 5 5
Do. 6 % Non-Cum. Pref.	5	..	..	1⅛ — 1⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	+2	5 4 8
Folkestone	5	6	6	4½ — 5	+ ⅛	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 4⅝	..	5 2 7
Do. 4½ % First Deb.	100	4½	4½	89 — 91	+2	4 19 0
Hove	5	8	8†	8⅜ — 9½	..	4 17 3
Kensington & Knightsbridge, Ord.	5	8	8†	7⅜ — 8¼	+ ⅛	4 17 0
Do 4 % Deb.	Stock	4	4	89 — 91 xd	..	4 8 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	+ 2	5 12 0
London Electric, Ord.	8	2½	..	1⅜ — 1⅝	+ ⅛	4 5 0
Do. 6 % Pref.	5	6	6	5⅜ — 5⅝	+ ⅛	5 6 8
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 3
Metropolitan	5	4	4†	3⅝ — 4⅛	+ ⅛	4 17 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 14 9
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 — 100	+1	4 10 0
Do. 3½ % Mort Deb.	Stock	3½	3½	81 — 84	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	100 — 103	..	4 17 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10½	..	5 14 3
Oxford	5	7	6†	6 — 6⅜	..	5 7 8
St. James' and Pall Mall, Ord.	5	10	10†	9⅛ — 9⅜	+ ⅛	5 2 7
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 18 3
Do. 3½ % Deb.	100	3½	3½	82 — 85	..	4 2 4
South London, Ord.	4	5⅛	..	3⅛ — 3½	+ ⅛	6 6 9
Do. 5 % First Mort. Deb.	100	5	5	98 - 101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 14 9
Do. 4½ % First Deb. Stock	100	4½	4½	93 — 96	..	4 13 9
Urban, Ord.	£3	Nil	..	⅜ — ⅝	+⅛	..
Do. 5 % Cum Pref.	5	3⅛	..	2½ — 3	..	5 0 0
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	+1	5 1 3
Westminster, Ord.	5	10	10†	9 — 9⅛	+ ⅛	5 5 3
Do. 4½ % Cum Pref.	5	4½	4½	5⅛ — 5⅜	+⅛	4 4 8

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ 3s. Cash and 2% in Funded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 3rd.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	5	6	6†	5⅛ — 5⅜	..	5 11 7
Calcutta, Ord.	5	8¼	5†	7⅜ — 8	+ ⅛	5 6 3
Do. 5 % Pref.	5	5	5	5 — 5⅛	+1/16	4 15 5
Calgary Power, 1st Mort. Bds.	100	5	5	89½ — 91½	..	5 8 3
Canadian Gen. El. Com.	$100	7	8	114 —118	+ 6½	6 15 7
Do. 7 % Pref.	$100	7	7	121 —126	+2	5 11 1
Cordoba Lt., Power and T., Ord.	1	5	..	7/16 — 9/16	..	7 12 0
Do. 5 % Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	87½ — 89½	..	6 14 1
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	96 — 98	+1½	5 2 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6†	4⅞ — 5⅛	..	11 5 8
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1⅛ — 1⅜	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 0
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	70 — 74	+2	6 15 2
Mexican Lt. & Power, Common	$100	4	4†	51 — 54	+4	..
Do. 7 % Cum. Pref.	$100	7	7	86 — 90	+1	7 15 7
Do. 5 % 1st Mort. Gold Bds.	..	5	5	84 — 87	+3	5 15 0
Do. 5 % 2nd Mort. Bonds	100	5	5	70 — 74	+1½	6 15 2
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	64 — 69	..	£ s. d. .. ..
Montreal, Lt., H. and Power	$100	9	10†	220 — 225 xd	+2½	4 9 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 — 20	..	.. ..
River Plate, Ord.	Stock	10	..	207 —217	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	103 —108	+2	5 11 1
Do. 5 % Deb. Stock	Do.	5	5	101 — 103	+2	4 17 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	102 —104	+3	4 6 7
Shawinigan Water, Capital	$100	5½	6†	139 —144	—1	4 3 4
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	104½—106½	..	4 14 9
Do. 4½ % Per. Deb.	Stock	4½	4½	97 —100	+1	4 10 0
Toronto Power, 4½ % Deb.	Do.	4½	4½	95 — 98	..	4 11 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	87 — 89	..	5 12 4
Victoria Falls Power, Pref.	1	6	6	13/16 — 7/8	+1/32	6 17 2
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	108 —105	..	5 14 8

MANUFACTURING COMPANIES.

Aron, Ord.	1	7	..	1 1/16 — 1 3/16	..	8 12 4
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	7 7 8
Babcock & Wilcox	1	16	14†	3½ — 3 5/8	+5/32	4 18 6
Do. Pref.	1	6	6	1 5/16 — 1 7/16	..	4 3 6
British Aluminium, Ord.	1	..	..	1 3/8 — 1 7/16	..	..
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	+1/32	6 8 0
Do. 5 % Prior Liens Debs.	100	5	5	94 — 97	..	5 3 0
Do. Deb. Stk.	100	5	5	85 — 88 xd	+1	5 13 8
B.I. & Helsby Cables	5	10	8†	8⅞ — 9⅜	+ ⅛	5 6 8
Do. Pref.	5	6	6	5⅛ — 5⅜ xd	+ ¼	4 14 1
Do. Deb.	100	4½	4½	100 —103	+1	4 7 3
British Thomson-Houston, Deb.	100	4½	4½	92 — 95	..	4 14 9
British Westinghouse, Pref.	2	Nil	..	1 3/16 — 1 7/16	+1/16	Nil
Do. Deb.	100	4	4	68 — 71	+1	5 12 8
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 6
Browett, Lindley, Ord.	1	..	..	2/- —3/-	..	Nil
Do. Pref.	1	..	..	8/- —8/6	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	78 — 83	..	6 0 6
Do. 4½ % Deb.	100	4½	4½	39 — 43	..	10 9 4
Do. 4½ % Second Deb.	100	4½	4½	23 — 27	..	16 18 4
Callender's Cable	5	15	5†	11¾ — 12	+ ¼	6 5 0
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 9
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	22½	21½ — 21¾	+ ⅛	..
Do. Deb.	100	4½	4½	103 —106 xd	+1	4 5 1
Crompton & Co., Deb.	100	5	5	79 — 81	+4	6 3 5
Dick, Kerr	1	Nil	..	5/16 — 7/16	..	..
Do. Pref.	1	6	6	13/16 — 15/16	..	7 2 2
Edison & Swan, A, £2 paid	5	Nil	..	0 — 1/16	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	58 — 62	+4	6 9 1
Do. 5 % Second Deb.	100	5	5	63 — 68	..	7 7 1
Electric Construction	1	5	..	5/16 — 11/16	+1/16	7 5 6
Do. Pref.	1	7	7	13/16 — 1 3/16 xd	..	6 15 7
Greenwood & Batley, Pref.	10	7	7	6¾ — 7¼	..	9 13 2
Do. Deb.	100	5	5	92 — 94	..	5 6 6
General Electric, 6 % Pref.	10	6	6	9⅞ — 10⅜	+ ⅛	5 15 8
Do. Deb.	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	10†	13½ — 14	..	5 7 1
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	+1/16	4 9 0
Do. Deb.	100	4½	4½	100 —102	..	4 8 3
India-Rubber, G. & T.	10	7½	7½	10½ — 11½	— ½	6 10 5
Do. Pref.	10	5	5	9 — 9¾	..	5 2 7
Telegraph Construction	12	20	5†	38 — 40	+1	6 0 1
Do. Deb.	100	4	4	96 — 98	..	4 1 8
Willans & Robinson, 4 % 1st Mort. Deb.	100	4	4	65 — 69	..	5 16 0
Do. B 4 % Cum. Pref.	100	..	..	51 — 56	..	..

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4½	4½	6⅜ — 6¾	..	6 13 4
Do. 5 % Deb. Red.	Stock	5	5	98 — 96	..	5 4 0
American Telep. & Teleg., Cap.	$10	8	8	124 —127	—8	6 6 0
Do. Collat. Trust	$1000	4	4	89 — 92	—1	4 7 0
Anglo-American Telegraph	Stock	8	8	65 — 68	+3	4 8 3
Do. 6 % Pref.	Do.	6	6	103½—109½	+2⅜	5 9 10
Do. Def.	Do.	30/-	..	24⅛ — 25⅛	+1⅜	5 18 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	103 —105	..	4 15 2
Chili Telephone	5	8	..	7⅜ — 7⅝	+1/16	5 5 0
Commercial Cable, Stg. 4 % Deb.	Stock	4	4	80½ — 82½	+1½	4 17 0
Cuba Telegraph	10	6	6†	8⅜ — 9⅜	+ ⅛	6 8 1
Do. 10 % Pref.	10	10	10	15½ — 16⅜	+ ⅛	5 19 5
Direct Spanish Telegraph, Ord.	5	4	4	3¾ — 4	+ ⅛	5 0 0
Do. 10 % Cum. Pref.	5	10	..	7⅛ — 7⅜	+ ⅛	6 9 0
Direct United States Cable	10	4	4†	6⅛ — 7⅜ xd	+ ⅛	5 8 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	97 — 99	..	4 10 10
Eastern Telegraph, Ord. Stock	Stock	7	7	131 —134	+3	5 4 6
Do. 8½ % Pref. Stock	Do.	8½	8½	78 — 80	+2	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 4
Eastern Extension	10	7	7	12⅜ — 13	+ ⅛	5 7 8
Do. 4 % Deb.	Stock	4	4	93 — 95 xd	+1	4 4 4
Globe Telegraph and Trust	10	6	6†	11⅛ — 11⅞	..	5 2 2
Do. 6 % Pref.	10	6	6	12⅛ — 13	+ ⅛	4 12 4
Great Northern Telegraph	10	20	5†	31½ — 33½	..	5 19 5
Indo-European Telegraph	25	13	5†	58 — 60	+1	5 8 4
Mackay Companies Common	$100	5	5	83 — 87	..	5 16 0
Do. 4 % Cum. Pref.	$100	4	4	67 — 71	..	5 12 8
Marconi's Wireless Telegraph	1	20	20	3⅛ — 4 1/16	+1/16	4 18 6
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅛ — 3⅜	+1/16	4 17 2
Monte Video Telephone, Ord.	1	6	6	5/16 — 7/16	..	6 17 2
Do. 5 % Pref.	1	5	5	3/16 — 5/16	..	6 18 4
New York Telep., 4½% Gen. Bnds.	100	4½	4½	100 — 101	..	4 9 0
Oriental Telep. and Elec.	1	10	10†	1⅞ — 2	..	5 0 0
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	+1/16	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	87 — 89	+ ½	4 10 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98 — 100	..	4 0 0
Reuter's	10	10	10†	9 — 10	..	10 0 0
Submarine Cables Trust	Cert.	6	6	123 —126	+ ½	4 15 3
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 — 98	..	4 11 10
United River Plate Telephone	5	8	6†	6⅜ — 7⅛	+ ⅛	5 10 5
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	+ ⅛	4 9 0
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 3 0
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	95 — 98	+1	4 1 8
West India and Panama Teleg.	10	1½	1½	2⅝ — 2⅞	+1/16	4 8 6
Do. 6 % Cum. 1st Pref.	10	6	6	9⅝ — 10⅜	..	5 17 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9 — 9⅝	..	6 6 4
Do. 5 % Debs.	100	5	5	97 — 99	..	5 1 0
Western Telegraph, Ltd.	10	7†	7	13⅛ — 13⅝	+ ⅜	5 2 8
Do. 4 % Debs.	Stock	4	4	95 — 97	+2⅜	4 2 8
Western Union 4½ % Fdg. Bonds	$10.0	4½	4½	95 — 98	..	2 11 10

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

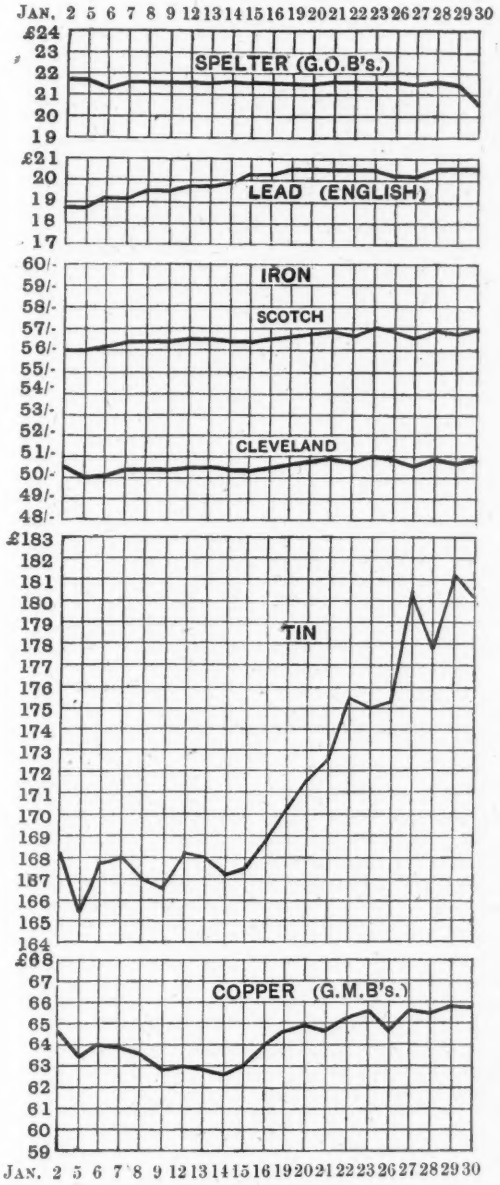
Bank rate of Discount 3 per cent., January 29th, 1914.

Central Suspension Lighting.—In connection with the Road Board's recent pronouncement in favour of central suspension lighting, and pending also the settlement of the compulsory powers which are being sought to attach fixtures to frontagers' buildings, the London Electric Firm, of Croydon, point out that existing tramway pillars may in many cases be utilised for carrying the span wire for the support of the arc or metal-filament lamps. As lowering gear specialists, they are prepared to undertake the carrying-out of schemes of this nature.

Electric P.O. Vehicles in U.S.A.—According to the *Electrical World*, the Indianapolis postal authorities recently hired two Waverley electric vehicles for parcel delivery work, owing to dissatisfaction with petrol delivery vans. The P.O. supplied the drivers, and the owners maintained the batteries. It was found that in a 8½-hour day the petrol cars delivered 136 parcels, with 135 stops, in 45 hours, while in a 7-hour day the electrics averaged 271 parcels, with 189 stops, in 18·75 miles. The cost per petrol car was $8·5, excluding wages, and for the electric truck $5·6. As the result of the satisfaction given, the postal authorities have asked the Waverley Co. to provide additional vehicles on the same basis.

METAL MARKET.

Fluctuations in January.



Osram and Robertson Social and Athletic Club.—The eighteenth annual dance was held at the Brook Green Works, Hammersmith, on Saturday, January 31st. About 300 members and visitors were present, and full justice was done to the excellent programme provided. Members of the works fire brigade were conspicuously in attendance, most of them displaying an imposing array of medals. Much skill and taste was displayed in the fancy dresses worn, and the Dance Committee had a difficult task to perform in allocating the eight lady's and three gentleman's prizes. The latter were distributed by Mrs. C. Wilson, and in replying to the vote of thanks vociferously accorded by the gathering, Mr. C. Wilson (manager) announced that the directors had empowered him to give financial assistance to any employé whose health demanded special attention or a seaside vacation. Mr. Wilson emphasised the fact that assistance so given was not to be regarded as charity, but as a fair payment made by the company to maintain the health and efficiency of its workpeople. We were pleased to renew on this occasion our acquaintance with the recently opened cosy staff club premises; these are proving self-supporting in every respect, and over 100 luncheons are frequently served.

Gas Again.—A German correspondent writes that at Essek a family of four persons were suffocated on January 29th by gas escaping from a leak in the street lighting main, although the house itself has no gas service.

REVIEWS.

The Science of Illumination. By Dr. L. Bloch. Translated by W. C. Clinton. London: John Murray. Price 6s. net.

As Dr. Bloch explains in his preface, the first part of this book is devoted to an explanation of fundamental principles; methods for determining mean spherical and mean hemispherical candle-power are then considered in some detail, and the final chapter deals with indirect lighting. It is interesting to note that the greater part of the experimental and practical data incorporated in this work have been obtained in the experimental lighting station of the Berliner Elektrizitäts-Werke.

As this is a translation of a German book, we have to congratulate Prof. Clinton upon his undertaking, for he has rendered the matter most clear and interesting.

At the outset the author explains all the photometric terms in a manner which can be easily understood by his readers; certain debatable points are discussed at length, as, for instance, Glare. The table at the conclusion of Chapter I should be of use to those who have only just entered upon the subject, since the connection existing between the fundamental units is clearly set out.

In the next chapter many methods are given for the measurement and calculation of luminous intensity, but to the average reader we are afraid that the calculus will prove somewhat of a bugbear, for knowledge of this section of mathematics is, in our experience, extremely limited; the careful student will, however, follow the steps with interest and obtain a very clear conception of the matter. The graphical construction of Kennelly's method is perhaps not quite so obvious as it might be, but can be fathomed by studying closely the attached figure. Rousseau's method is clearly put, and the mathematics of it concisely stated. To those whose duty it is to determine the mean spherical or mean hemispherical candle-power, we recommend Dr. Bloch's own formulæ, namely—

$$I_0 = \tfrac{1}{8}\,(I_{30^\circ} + 2\,I_{60^\circ} + I_{80^\circ} + I_{100^\circ} + 2\,I_{120^\circ} + I_{150^\circ})$$

and

$$I_0 = \tfrac{1}{4}\,(I_{30^\circ} + 2\,I_{60^\circ} + I_{80^\circ})$$

where I_{30} &c., are the candle-power intensities at the indicated angles. We have used these formulæ for rough determinations and found them reasonably accurate.

It is pleasing to note that the author emphasises the fact that the luminous intensities of different sources are not always capable of direct comparison, and later on points out that conclusions arrived at in comparing the sources are never free from error and often entirely untrustworthy. Under the heading: "The Influence of Globes and Reflectors," Dr. Bloch again indicates possible sources of error in making comparisons. A detail which, however, has evidently escaped notice is the necessity of providing reflectors with either a matte surface or else a corrugated surface in order to prevent striations in the resultant illumination.

In view of the recent discussions on the question of street lighting, the views set forth are extremely interesting, and the conclusion arrived at is well worth consideration, namely, that the results are best estimated on the basis of horizontal illumination at a height of 5 ft. (1·5 metres) above the ground. For interior illumination, the author puts forward a height of 2 ft. 7½ in. to 3 ft. 3½ in. (·8-1·0 metres). The calculation of illumination is very fully dealt with, but we cannot credit that the calculations suggested are necessary; indeed, it would be impossible to find time to go through any but the most important schemes in such a thorough manner. The curves are instructive, but nowadays there are so many reflectors on the market with so many distributions that it would be necessary to have a luminous flux curve, as put forward, for each one, a most formidable task. The numerous examples using this "simplified" method are really necessary, in order to grasp the author's meaning, but, when compared with more simple charts and methods which have come under our notice, are tedious. Accuracy is to be desired, but when it is well-nigh impossible to detect a variation of two to one at intensities generally employed, it is doubtful whether it is worth while making intricate calculations which can be, and usually are,

upset owing to variations impossible to prevent in a commercial undertaking, such as, for example, voltage, gas pressure, &c. This attention to detail marks the book as German and theoretical, and not at all commercial.

The author is under a misapprehension when he dwells upon the variation of illumination values with height of suspension and other details connected therewith. He apparently loses sight of the fact that for a certain intensity the lamp may be placed at almost any height, provided that it is equipped with the correct reflector. In fact, he takes no account whatever, in this portion of his book, of shade and reflector design, a matter greatly to be regretted in such a work. At the end of the chapter a few paragraphs are devoted to some interesting data on gas lighting and rough calculations of lighting costs.

Several portable photometers are briefly described, and in the following pages figures and curves of actual tests are displayed, together with deductions therefrom. Here, again, the detail is laboured to a doubtful point; the final table of results, however, should be extremely useful, since it embodies data upon all types of lighting units.

The final chapter is devoted to indirect lighting and contains some extraordinary statements; the matter and calculations are again in detail, but there is much to be gleaned and a perusal of these pages is well worth while. Unfortunately, the table of results given by Dr. Bloch deals only with arc lamps, and in this respect one misses data embodying the use of metal-filament lamps. The chapter finishes with a short paragraph on semi-indirect lighting. The appendices are a feature of the book, and much useful information is to be found condensed in the last few pages.

The references given in the footnotes throughout the work are particularly pleasing, and on this account one can with ease make reference to amplified dissertations. The book will be found useful by those who are interested in illuminating engineering, especially from a theoretical point of view, but it is doubtful whether it will find a very wide circulation in this country. Dr. Bloch and his translator are to be congratulated upon their colossal undertaking.

Electric Furnaces in the Iron and Steel Industry. By Dipl. Ing. W. Rodenhauser and I. Schoenawa. Authorised Translation and Additions by C. H. vom Baur. London: Chapman & Hall, Ltd. 1913. Price 15s. net.

There is no doubt that the application of electricity to metallurgical industries opened out the widest field of possibilities for industrial science. The electric furnace, which was only an idea at the end of last century, has now become a familiar aid to the metallurgist. Progress has been extremely rapid, a fact which is due both to the electrical engineer, and also to the needs of many advanced industries. Electrical heating was first used on a large scale in the production of aluminium and calcium carbide, and later of ferro-alloys. The success of the latter led to the introduction of the electric furnace in steel production, with even better results. The present volume deals exclusively with electric steel furnaces, and is the only book of its kind yet published. Previous authors have dealt with the subject of electro-metallurgy in great detail, but none has confined himself exclusively to the production of iron and steel. This book, therefore, may be regarded as an epoch marker in a new industry. The book is designed, according to the author's statement, for the practical man; yet it explains the electric laws and phenomena involved, as well as the scientific principles upon which the work rests. The authors also hope to render the book of service to the general student of this branch of electrochemical engineering, and elucidate especially the principal laws on which the construction and operation of electric furnaces depend, without giving long mathematical discussions.

The authors have commenced a task which is almost impossible to carry out. The first part of the book is largely devoted to both mathematical and electrical principles. The nomenclature alone is beyond the grasp of the average practical man, and in spite of numerous examples, is of little value except to the advanced student and engineer. The various furnaces now in use are each described in turn, and a vast amount of valuable data is reproduced. The practical nature of this part of the volume renders it invaluable. It is written with the undoubted authority of a personal knowledge of both furnace construction and steel production. A vast amount of material has been brought together in a readable form, which has hitherto been hidden in publications inaccessible to most metallurgists. Part I begins with a historical review of the development of the electric furnace. This is necessary for the complete work, but contains nothing new. The arc furnace is first described in its various forms, including all the successful and well-known types. The following chapters are devoted to the various forms of the induction furnace, amongst which is described the one named after the author. This part of the book concludes with a list of firms using electric furnaces up to the date of publication, the type of furnace in use, the power consumption of each unit, and the class of steel produced. A very casual glance at this list is sufficient to show where progress is being made. England is almost unrepresented. By far the largest number of furnaces are installed in North America. This, of course, is due largely to the great number of waterfalls suitable for the development of water power in the country last mentioned.

The second part of the book treats of the materials of furnace construction and the cost of operation. It contains much valuable information resulting from practical experience, and will form a permanent work of reference to those interested in electric steel production. The third part of the volume is devoted to the electric smelting of iron ores for iron and steel production. This part is one of the most interesting, as it deals with an industry which is at the present time emerging from the experimental stage. Attempts are now being made to introduce the methods described into countries where water-power is plentiful, but where coal is scarce. When they are in operation huge tracts of now practically useless mineral-bearing lands will be thrown open for development.

The book is copiously illustrated, both with diagrams and photographs, and gives an excellent idea of actual working details. It is beyond all doubt a standard work, and must remain so for many years. The mathematics is of necessity complicated, and it is impossible to make it otherwise, in spite of the authors' statement to the contrary, in their preface. About 40 abbreviated signs are required for the various formulæ, which gives a fair indication of the nature of the mathematics. This difficulty, however, is wisely overcome by numerous practical examples, which constitute one of the best features of the book. The many practical difficulties arising out of the electric steel industry are discussed in detail, and the solution is given when known. The volume is full of valuable information from beginning to end, and the best thanks of all metallurgists are due to the authors.

Reduction in German Lamp Prices.—It is announced that, as a result of notice given by the A.E.G., the price convention existing between the A.E.G., the Siemens & Halske Co. and the German Incandescent Gas Light (Auer) Co. in regard to the new half-watt lamps has just been dissolved as a consequence of foreign competition. This rivalry has hitherto not been manifested by a reduction in the list prices, which have ranged from 15s. to 38s. for the high candle-power lamps concerned, but by an increase in the discounts, which already rise to as high as 30 per cent. It is explained in circles associated with lamp makers that the dissolution of the convention represents no incisive action, as it is desired to secure greater liberty of movement in relation to sellers of lamps and installation contractors. A similar purpose is sought to be served by the indirect reduction which has recently also been made in wire lamps for normal powers by three members of the Metallic Wire Lamp Convention, with the object of parrying the competition of the manufactures of smaller firms. In this case the list prices have scarcely undergone any change, but discount rates have been raised in some instances.

Wireless Operator's Heroism.—The wireless operator on the liner *Monroe* which was sunk in collision last Friday, named Ferdinand Kuhn, after sending signals for aid up to the last moment, put on a lifebelt; but seeing a woman without one, he gave her his own. Immediately afterwards the ship sank, and he was drowned. The woman was rescued.

BOOSTERS IN CONTINUOUS-CURRENT NETWORKS.

By H. M. TAYLOR.

In dealing with the question of distribution of continuous current in a town network, the difficulty of maintaining constant pressure in the suburbs is constantly felt. Again, the introduction of heating and cooking devices is rendering the trouble still more acute.

Small outlying districts using but, say 50 amperes, on each side of the three wire system can easily suffer to the extent of 5 per cent.

Additional feeders are too costly for such a case, and again, to be of any use, would have to be of very large section, or have feeder boosters inserted at the generating station.

Such districts, when entirely private houses, notice the effect far more than shop districts, as on shop closing nights—weekdays and Sundays—the consumers still have the usual number of lights on, but the bar voltage at the generating or sub-station is not so high, and every night the voltage varies throughout the evening.

Apart from the question of the voltage of the outers, quite a small out-of-balance will cause great neutral drop over such a long distance.

At Middlesbrough such a case arose in a district of large private houses taking a total of 50 amperes each side of the three wire system. Most of these were on a pair of 0.1 triple distributors, which left a three-way box in the network at a point situate 1,950 yards from the generating station nearest run, and 1,000 yards from the nearest feeder and nearest run. (See figure 1.)

Had a new feeder to this box been run it would have been put in at least 0.4 section to allow for future developments, and thus at its present light load it would have suffered severely from the alterations of the station bus-bar voltages on various days and at various points of the load. In fact, feeder-boosters would have had to be installed at the works. The cost of such a scheme would have been prohibitive. The case is very typical, and can be found on almost every network, and the cure should be of especial interest to the "Point Fives." This cure was brought about as follows:—

A booster set was fixed in a tank at point A. The booster consists of 2-100 ampere by 30 volt boosters, one on each side of the three wire system, driven by a 440 volt motor. At the side of the tank, which is under the footway, is a feeder pillar. The pillar contains disconnecting switches for the boosters, which also shortcircuit the booster connections, and two Taylor Scotson automatic voltage regulators which cause the boosters to keep the voltage at the required point.

The booster set is started and stopped by an automatic starter on the motor actuated by a time switch, as it is only proposed to run the boosters during lighting hours.

In some cases this time switch might be replaced by an automatic arrangement which would start the booster set whenever the voltage varied more than a selected amount, but it was felt that the time switch was more positive and preferable. The underground tank is ventilated into the pillar, and as this has been carefully designed, the effect is such that there is no danger of moisture in the booster tank causing a burn out of the set.

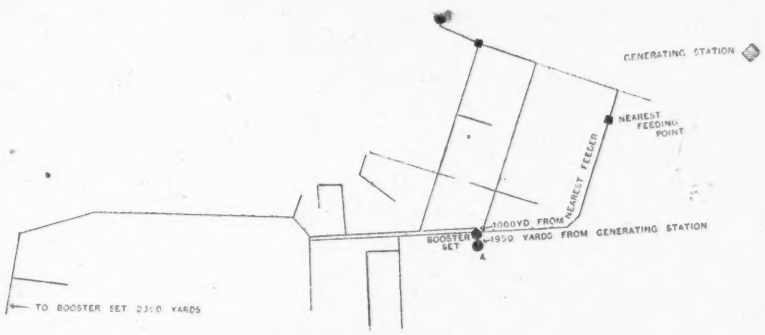


Fig. 1.—Boosted Network.

The effect has been that the Taylor-Scotson regulators maintain the voltage within ¼ per cent. throughout the run. To show the necessity of the layout, the booster has at times to give up to 24 volts per side, indicating the condition of things (before it was fixed.)

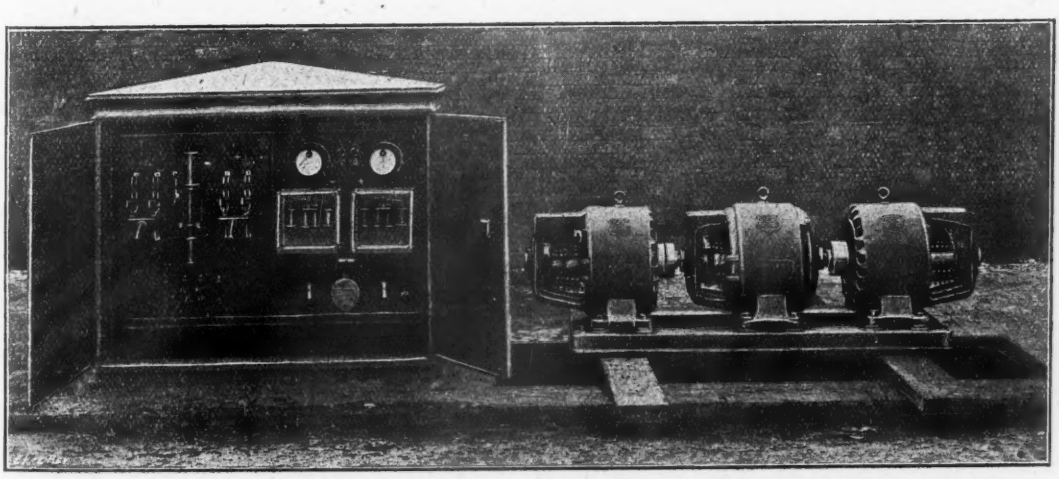


Fig. 2.—Feeder Pillar and Booster.

The pressure maintained is 230 per side on a declared consumers' pressure of 220 volts. The time switch is set to stop the set when the load is sufficiently light, at present half an hour after midnight.

It may be argued that taking the current from the incoming cables to drive the booster would severely affect the voltage on those cables. Such

current is quite small. With a boost of 24 v. by 50 amp. a side, or a total of 2.4 K.W. only, say 6 amperes is needed on the 440-volt motor. It is not proposed to leave the arrangement for all times.

When the district develops sufficiently to allow of a rotary sub-station being provided or even an alteration to the feeder system being justified, the layout may be moved to test the development of another outlying district, but at the present time no other arrangement could be faced on account of cost, nor would it have given such good results.

The system was designed by Mr. H. M. Taylor, Borough Electrical Engineer, Middlesbrough, and his assistant, Mr. R. H. Scotson.

The layout was assembled by the British Insulated and Helsby Cables, Ltd., the boosters being supplied by the Lancashire Dynamo and Motor Co., Ltd., and the Taylor-Scotson automatic regulators and switchgear by Messrs. Cox Walkers, Ltd., Darlington.

VILLAGE LIGHTING.

[COMMUNICATED.]

THERE has been during the past year or so a remarkable increase in the number of small towns and villages lighted by electricity. The two chief reasons are the advent of the metal filament lamp and the relaxation of the unreasoning prejudice against overhead wires that has prevailed in this country.

The writer started a supply in a village with 800 or so of population five years ago, when he saw that the new lamp justified the expectations that had been formed, and had come to stay. He has in these five years accumulated some experience in this particular branch, which differs, as has been pointed out in this paper, in material respects from the ordinary run of city and large town work. Having been appealed to several times for data regarding size of plant required, units used per lamp per annum, etc., by others who were contemplating the launching of similar schemes, he feels that a few notes on the subject might interest some readers.

It is as well to point out at once that there was no gas supply in existence in this village, which fact was certainly a point in favour; at the same time, in the few instances where there are gas undertakings in the district, in small towns or villages at all comparable in size with the one under notice, the price of gas runs out somewhere near six shillings per thousand feet, so that it does not follow that it would have been so very formidable as a competitor. He would certainly be a very daring speculator who would now contemplate the construction of a gas works.

At the same time, the idea of electric light being supplied cheaply enough to replace the existing paraffin lamps was treated with scorn and derision by a great number of the inhabitants, and looked on with doubt by almost all—it was not considered to be within the range of "practical politics."

However, a few of the leading inhabitants took enough interest in the idea to meet the propounder of the scheme, and listen to his explanation of the possibilities of the wonderful new lamp, illustrated with figures giving the number of hours' light obtainable for a penny on the basis of the proposed charge per unit, and, under the influence of the said figures, and of personal faith in their author, decided to raise a few hundred pounds, a very few, to give the idea a trial.

The first procedure was the formation of a company, limited of course. The legal work in connection with this was undertaken by a solicitor friend of one of the shareholders, for the lump sum of £25. Almost the first question to arise was the advisability or otherwise of seeking a provisional order. As the only substantial benefit of this would have been to secure compulsory wayleaves, and as the promoter of the scheme had already in his possession letters from the two road authorities, the County and Rural District Councils, giving their assent to the placing of poles upon the roads in approved positions, it was decided not to apply. Another satisfactory reason was, that it would have taken a large slice of the money promised, so large as to knock the whole thing on the head. By the way, there is a generally prevalent idea that a scheme of this kind could not be started without a provisional order. This is, of course, not so, provided that a provisional order granted to someone else does not cover the district.

An immediate start was made. The voltage decided on was 100, and the system 2-wire direct current. The low voltage may be explained by the fact that at that time the metal filament lamp was not available in the higher voltges. Wooden poles and bare wire, of course.

As to power, an oil engine was mentioned, but eventually, owing to special local circumstances, steam power was adopted, even on this small scale, and has continued to the present date, and it must be said that at the present cost of paraffin, steam, even with a small simple non-condensing engine, is cheaper by 50 or 60 per cent. The whole plant is of the very simplest, the switchboard being just the ordinary pattern arranged for battery charging, there being till recently only one feeder, controlled by D.P. switch and fuses on the board. Owing to extensions recently another feeder was added, which requires a slightly different voltage on its terminals.

It may be remarked that prior to the decision to proceed, a canvass was made of the tradesmen on the route along which mains were proposed, and enough favourable replies were received to warrant a start being made. Here the writer may interject his opinion that such a canvass is of little value, as, in the end, it is on its merits that such a scheme will gain or lose support, and there is little doubt that had anything untoward happened in the case of the first customer or two connected, the remainder would not have hesitated to cry off, and naturally so, for the wiring of premises costs something.

Concerning this point of wiring, the promoters decided to do nothing with free wiring in any shape or form, and every point wired in the village to this day has been done at the expense of the landlord or occupier. As to mode of wiring, after every system has been considered, things have settled down to a standard of wood casing, with an occasional job in twin V.I.R. lead-covered, and very little indeed of conduit.

Then came the question: Meter or no meter? Considering the present price of fairly good meters, the engineer plumped for meters, and they were adopted. They consist mainly of a well-known cheap motor meter, and an electrolytic penny-in-the-slot pattern meter. Despite the one or two drawbacks appertaining to the latter, such as a tendency to short circuit if not very regularly attended to, and the need of frequent renewals, it has been very useful in attracting a certain class of consumer, and there are several in use, especially in cottages of a rental of half-a-crown to five shillings per week. Meter rents are charged of ninepence per quarter on the motor meters, which are seldom over 2½ amps. in size, and a shilling per quarter on the slot meters.

In these small plants, one trouble is that labour costs come very heavy in proportion to the number of units generated, and this is unavoidable, as a small plant of say 10 H.P. needs as much attention almost as one of 50 H.P. or 100 H.P. This being so, the writer advocates the putting down by all means

of a plant of such size that it need never be run in the day-time, the battery and generator being so proportioned that a run from dusk to 10 p.m. or so, at full, or nearly full, power, does all that is needed. This obviously tends to economy in both labour and fuel. Here, of course, reference is made to plants having a purely lighting load, and no day load.

With regard to motive power, paraffin, which would perhaps be looked on as most suitable for the size of plant under consideration (say 10 to 18 H.P.) has become so dear that with it the fuel cost per unit comes out rather high; the crude oils are cheap, but apparently the price depends on the personal whims of a few people who manipulate it at their pleasure, and this seems to the writer sufficient reason to fight shy of this source of power so long as there is any other source about as cheap. There remains the suction gas engine and the semi-portable superheated steam engine. The writer must confess to a partiality for steam, especially as in the kind of scheme under consideration probably only one engine would be put down, the increased capital charges entailed by having two engines being a factor to be seriously considered. But it is doubtful whether such engines are to be had for such small powers, and if so, at sufficiently low prices.

The suggestion is here thrown out that as a stand-by, a high speed petrol engine, even a second-hand car or boat engine, might be installed. The capital cost would be very low, and durability and economy, in the case of an engine for emergency use, such as this one, would be of comparative unimportance. Before leaving this subject, it may be as well to point out that in districts where coal is fairly cheap, and water plentiful, even the old type of semi-portable steam engine, with an ejector condenser attached, can produce current at less than a penny per unit for fuel, including the raising of steam.

To revert to the particular scheme mentioned, this has now run for nearly five years, current being available day and night, without any failure whatever. The Osram lamp was the only suitable lamp available at the start, and this lamp has been used practically throughout. There are many of the original lamps still in use, and the fear entertained at first, of frequent lamp renewals discouraging consumers by their cost, has turned out quite unfounded. An account has been kept of every lamp sold for replacement, and it is found that, for every 100 lamps installed, 15 renewals were sold each year, but it must be remembered that a fair proportion of the total at any time would be comparatively new lamps, so that the figure mentioned will be on the low side. However, it has been established that the cost to consumers of lamp renewals has been quite trifling.

Comparing the cost of current with that of paraffin oil, it can be said right away that, even at a price double that obtaining in large towns, it has proved much cheaper, and, of course, when trouble, dirt, &c., are taken into consideration, there is absolutely no comparison. Electric light would be used in every house without exception, large and small, in the place to-morrow, as far as the cost of current is concerned. It is only the wiring question that is in the way.

Many questions have been addressed to the writer by persons contemplating similar schemes as to the power required, average size of lamp used, and units consumed per lamp installed.

These are evidently vital questions, and on the replies to them depends the commercial practicability of the schemes. Briefly, as far as his own experience goes, electric lighting is practicable in any fairly busy village of a population of 600 or so upwards. This means with a concern "on its own bottom," and not taking a supply from a neighbouring large town, in which case the conditions are quite different. It also implies paying reasonable wages for the class of work to be done, and the time put in; it makes a great difference if the man in charge has some other like occupation to fill up his time in the case of a very small plant.

It is found in the village supply mentioned that the sizes of lamp most in use are the 15-watt, 20-watt and 25-watt. The latter are found sufficient to light living rooms, where a single lamp is used; in the case of three-light fittings, generally three 15 or 20-watt lamps are used, and it is noticed that the three are seldom on together, two being quite enough as a rule. Very few lamps indeed are required larger than 30-watt. The average wattage per lamp installed is 20, and for every 100 lamps installed the maximum load at the switchboard has been 0.7 K.W. The load curve is of such a contour that a generating set capable of dealing with this maximum load, without withdrawing from the battery at the time of the peak, is found to be large enough to do all that is required within the limits previously mentioned, dusk to 10 p.m. When worked out for any particular case the size of generating set may seem low, but this in any case is the writer's experience, and there is no reason to believe that the habits of inhabitants of villages in different parts of the country vary very much. The tendency, so far as seen, is to put in plant far too large, thereby unnecessarily increasing fuel and capital charges. The clientele in the example under notice consists of private houses, mostly fairly small, houses and shops combined, such as one sees in the country, five public-houses, two small works, and three places of worship. The units consumed per annum per lamp installed in this mixture are 10, and the number of lamps installed per consumer is also 10. Sorting the different classes out to some extent, the units per annum per lamp are as follows:—

Private houses, wired throughout, including upstairs	5
Private houses, wired downstairs only	8½
Houses and shops combined	13½
Public-houses	17

These figures may be of some use to others contemplating like installations; but it is necessary to point out that these figures were obtained on a 100-volt system, and as probably nearly all new schemes would be at 200-volts or over, a percentage should be added in view of the lower efficiency of the higher voltage lamp.

A word or two might be said re cost of repairs. During the five years or so that have elapsed since the initiation of this scheme, the repairs item has been really negligible apart from replacements of battery plates, which have amounted to somewhere about ⅛d. per unit. Although there have been some exceptional storms in this period, not a pole nor wire has flinched in the mains and services. Altogether, the expenses under this heading have disappointed the promoters on the right side.

A suggestion was made in the Electrical Review some months ago that a qualified man might in many cases supervise groups of these village plants, a man at lower wages, not necessarily even a mechanic, being put in charge of each. This plan would ensure a reasonable cost of operation, and yet provide for expert supervision. This had also occurred to the writer, and he believes that it would have a great deal to do with the commercial success of such schemes.

One small point is worthy of mention. Current being necessarily somewhat dear on these small jobs, it is to the suppliers' interest in the end to see that wiring is done so as to get the greatest efficiency in the way of *effective* light per unit sold. It has frequently been the writer's experience that a lamp placed too high, and also having an unsuitable shade, has been the cause of dissatisfaction,

whereas the lowering of the lamp, and the substitution of a plain conical nine or ten-inch white opal shade, the same c.p. being used, has effected a complete transformation. Where ornamental shades have been insisted upon, it has been the practice to call the consumer's attention to the fact that he will need to use more current for the same effective light, and leave it at that; this procedure makes things clear, and often saves the supplier from unfounded complaints.

THE ELECTRICITY OF THE ATMOSPHERE.

Sir Oliver Lodge, in delivering the fifth Kelvin lecture at the Institution of Electrical Engineers on Jan. 22nd, chose as the title of his subject "The Electrification of the Atmosphere, Natural and Artificial."

Opening the lecture with some striking portraits upon the screen of the late Lord Kelvin at the principal epoch-marking points of his career, Sir Oliver proceeded to refer to the early researches carried out by Lord Kelvin in connection with the subject of his lecture. The method of measuring adopted in these pioneering experiments was by means of the portable electrometer devised by Lord Kelvin, provided with an upright rod extending from it and having a smouldering taper at its upper end. This instrument having been placed in the atmospheric space to be tested, acquired the potential of the air surrounding the taper, and thus the electrometer portion of the apparatus indicated the electrical pressure prevailing in that quarter.

This method of "connection" with the atmosphere, and another, by means of dripping water running from the portion of the instrument, were the two means adopted at the present day in connection with atmospheric experiments of this kind.

Lord Kelvin, in the course of experiment, found that in fair weather the atmosphere contained a positive electrical charge, while in disturbed conditions due to wind or rain, and sometimes dust clouds, the charge was reversed to negative, due probably to the frictional effect of such conditions.

At a height of 9 ft. above the earth's surface the electrical potential was found to be as much as from 200 to 400 volts above that of the earth, while on occasion it rose to from 2,000 to 4,000 volts, being at a high pressure during stable atmospheric conditions and less when a disturbed condition prevailed.

While the electrical pressure "gradient" of the atmosphere was about 1 volt per cm., the amount of the charge was exceedingly little, being only one-millionth of a coulomb per sq. km. area.

The earth itself, as was well known, contained a negative charge of electricity at its surface, but Sir Oliver was not prepared to say definitely whether this was the cause or was the effect of the atmospheric charge.

It was also uncertain whether the atmosphere as a gas could be said to be charged at all, or whether, as had been propounded, the charge was contained in microscopic particles of dust suspended in the atmosphere.

The electronic researches of recent years had thrown much light upon atmospheric electrification. The discovery that ultra-violet light rays projected upon zinc caused electrons to be given off led to the conception that the same effect was produced in the atmosphere by such rays from the sun. This was further substantiated by the occurrence of thunderstorms after a prolonged spell of bright weather. The electrified state of the atmosphere at a high altitude was also demonstrated by the glow that appeared during storm conditions at the top of elevated objects such as masts and trees, well known as "St. Elmo's Fire."

In support of the view that vegetation generally appeared to be intentionally formed for its growth by the discharge of electrical pressures, photographs of various kinds of tree leaves were shown on the screen calling attention to their spiky construction, in which form it was clear that they were ideally suited for electrical discharge.

Referring to the remarkable forms of lightning flash observable during storms, some striking photographs of such flashes were shown on the screen. The fact that the air became more conducting on the occurrence of an electrical discharge gave rise to numerous branch discharges from the main trunk of a lightning flash; thus, although the main stroke might be led to a lightning conductor, it was important to bear in mind that the off-shoots were by no means to be despised in arranging for lightning protection. A remarkable form of flash was shown in which the lightning had, as Sir Oliver expressed it, tied itself in two or three distinct knots, this strange effect, he observed, being due to the procession of the electrical discharge through those rain drops that happened to be nearest to the immediate electrified portions of the flash as it formed. The Euclidean statement of the shorter path between two points being a straight line was apparently, he remarked, *not* taken seriously by lightning.

Another interesting effect produced by a lightning stroke was a broad band similar in appearance to certain forms of the Aurora Borealis, which, it was pointed out, might have been caused by "blowing away" of the electrical charge from the main body in its progress.

As an example of how the effects of lightning discharge might extend beyond the main path, a case observed by one of Sir Oliver's assistants was mentioned, in which a large iron-roofed shelter was affected by the "return stroke" effect of a distant storm, and notwithstanding its well-earthed condition through the iron stanchions on which it was supported, the discharge was sufficient to hurl for many yards a man who had been standing against one of the iron supports, and had apparently been further protected, standing, as he did, on a wooden chair watching a football match.

One of the main causes of atmospheric electrical charge was the alpha and beta rays produced by the sun's rays, this view being further supported by the powerful magnetic storms which were caused by sun spots. This radiation, giving rise to negative electrons, produced both positive and negative charges, of which the positive reached the earth in the neighbourhood of the tropics immediately beneath the sun, while the negative, due to ionisation in the upper parts of the atmosphere, were deflected toward the Polar regions, and were the cause of the Aurora Borealis. This electronic state of the upper atmosphere was the cause of the deflection of the Hertz waves used in radio-telegraphy, making possible their course around the curvature of the earth, instead of allowing them to radiate into space as they would otherwise do. The fact also that metals contained electrons caused their opacity to radio-telegraphic waves.

Sir Oliver then proceeded to refer to the actual commercial possibilities that were before mankind if experiments on a large and practical scale were carried out in further studying the electrical conditions and laws of the atmosphere.

Many of these had been demonstrated by laboratory experiments on a small scale; as, for instance, the coagulating of moisture drops in suspension by means of sufficient electrical charge to cause artificial rain. Thus in many arid regions round the tropics, owing to the insufficiency of the negative electrical condition, clouds laden with moisture constantly passed over, while the land beneath was parched for want of rain for the greater part of the year, and it had been suggested that with the means to deliver sufficient quantities of a negative charge into such clouds when desired, they could be made to deliver rain by the coagulation of their water particles.

He saw no reason why, with the many means available for sounding the heights of the atmosphere that were in present use, such as kites, sounding balloons and the like, an efficient conductor should not be sent up to such clouds and the desired charge applied.

The question of the quantity of the charge, he thought, was not as formidable as was generally assumed; once the coagulating action was set in motion, the increased conductivity of the air to which it would give rise would support further progressive action in itself. With regard to the type of electrical machine to be used for such work, they had many frictional electric machines that might be used, but there was still great room for improvement on account of the comparatively low speed of the mechanical members of such machines.

He himself had carried out extensive work on a practical scale upon the application of electrical charges to the atmosphere for the benefit of agricultural crops. In this work a positive charge was applied which acted as a supplement to the positive charges caused by the sun itself; thus, while the increase in the output of the crops treated over ordinary crops amounted to as much as 30 per cent. in ordinary seasons, in 1911, during which a great drought prevailed, no increase was recorded, the atmosphere having been sufficiently electrically provided, due to the sun alone. The charge was applied over the crop area to be treated by means of lines of No. 11 wire supported and insulated on poles 16 ft. above the level of the ground; between these lines cross wires of No. 24 wire were stretched. The pressure used was 100,000 volts, generated with power from a 2-H.P. oil engine. In this manner it had been found possible to increase the charged state of the atmosphere to 10,000 times its normally electrified state. It was also found that during windy weather the charged atmosphere was carried down wind sufficiently to show an effect upon other areas of the field, which fact in carrying out experiments it was necessary to take into account. The exact action of the charge upon vegetation was still undetermined, and such experiments needed the collaboration of the electrical engineer and chemist if they were to be of full value. There was reason to believe that certain plants of the leguminous kind would thrive better on the application of a negative charge.

A number of photographs of the equipment used in carrying out these agricultural electrical applications were shown on the screen; they consisted of various arrangements of electric "valves" of the vacuum type devised by Sir Oliver himself, in combination with induction coil apparatus, and an elaborate system of insulation, which, he remarked, had been one of the principal pioneering difficulties to overcome.

As exemplifying a directional idea rather than an immediate possibility of means by which the negative electrical charge gathered at the poles of the earth might be coaxed into regions where it would be of commercial use in the control of the weather and stimulation of crops, Sir Oliver pointed out that were the polarity of the earth to be modified by some such process as the construction of a girdle of conductors laid around the earth itself in some polar latitude, a heavy current might be conceived of, assuming the metallic core of the earth to be of high permeability, that would magnetise the earth sufficiently to bring about a substantial moderation of its polarity, sufficiently to attain the desired object. In view of the somewhat fantastic nature of this proposal at the moment, this statement should not, perhaps, be taken

seriously, although with regard to the conducting girdle, men had already laid great enough length of railway metals on the earth, considerably in excess of the amount that would be required.

In conclusion, his lecture was to be taken more as an agenda of the direction in which valuable results were obtainable if experiments were undertaken on the requisite scale, than as a record of results already attained.

BRITISH PRACTICE IN THE CONSTRUCTION OF HIGH-TENSION OVERHEAD TRANSMISSION LINES.*

Discussion at Leeds.

Mr. J. E. Storr (Mirfield) said that for voltages lower than 3,000 he did not agree that cables were cheaper than overhead wires. As to the factors of safety allowed to the postal authorities, he thought they ought to be increased, in view of the frequent crossing of their wires with power wires. In view of the trouble and difficulty of finding capable men—at any rate at short notice—he found the oiled twine packing a difficult operation to make a sound job of, and if it was not made right it was a weaker job than if the pin was cemented in the insulator. For changing the direction of a line, he thought the "A" pole would be stronger to take the strain than the "H" pole, unless very extensive trussing was adopted.

Mr. Kay (Callender's Cable and Construction Co.) directed attention to the firm's patent pole, and showed the illustrations of its structure which were reproduced on pages 128-9.

Mr. H. E Yerbury (Sheffield) said the equipment of high-tension overhead lines had almost reached the standardised stage, and the greatest obstacle seemed to be the obtaining of wayleaves. Greater progress would be made if æsthetic considerations were not divorced from strict utilitarian considerations. It would be more satisfactory if it could be arranged for all E.H.T. wires to be erected on or adjoining main roads or railways. He would like to know what the disadvantages of reinforced concrete poles were apart from the weight. He did not agree with the author as to the deterioration and maintenance of steel tramway poles. He had recently had occasion to remove many, after a life of 12 or 13 years, and they had been found to be practically as new. He used bases to all his poles, which added to their life. The poles were painted every three years, and the bases were raised. Most of the corrosion took place on the surface of the road where the bases were not used. From what he had seen, he felt thankful that there was a reasonable Board of Trade to regulate schemes in this country.

Mr. Chris. Wade (Hull) said it would be a great help to overhead work if anything could be done to make the granting of wayleaves compulsory. He was doubtful of the efficacy of Mr. Welbourn's suggestions as to tarring poles, or as to creosoting at the bottom of the poles, and he did not think that the Powell process of preserving timber could be a serious rival of creosoting.

Mr. Lang expressed fears as to what the countryside would look like when the time came which Mr. Ferranti had forecasted.

Mr. W. E. Burnand (Sheffield) said he thought that Mr. Welbourn was wrong in putting so much stress on the pressure of the wind and ice as being proportionate to the diameter of the wire. The thickness of ice on the wire did not vary very greatly with the diameter of the wire. The pressure of the wind should be taken as varying with the square root of the diameter. As to insulators, there was a weak spot in many cases which could not be shown by the ordinary test, and a high-frequency test should be made in addition. The tests made by Himley and Thomas on this point showed that there was no direct relation between the relative puncture strength and the flash over strength of the insulator as tested by high frequency. It was quite easy to arrange such a test.

Mr. T. B. Johnson (Leeds) asked upon what the author founded his comparison of the strength of the A pole and the H pole.

Mr. W. Wraith (Leeds) asked if the author had made any experiments with reinforced concrete poles.

The Chairman (Mr. Woodhouse) said that with reference to the possibility of disturbance from wireless telegraphy which the author had alluded to, he believed there were thoroughly authenticated cases of trouble with overhead wires from wireless stations close to them.

Replying on the discussion, Mr. Welbourn said that his comparison and the costs of overhead wires and cables had received strong confirmation from independent engineers who had looked into the matter. The figures given were from actual existing scheduled contracts, both for cable and overhead work, and represented average conditions, and they showed that the higher the voltage and the higher the kilowatts the greater the saving that might be made. Mr. Storr was quite right in suggesting that the Post Office factor of safety should be higher than the other. In his comparison of the A and H poles the figures of the A poles were taken from Mr. Chris. Wade's paper before the Institution, which was admittedly the classic on that subject. In regard to the strengths of H poles he found the most extraordinary discrepancies of testimony. He had, therefore, got his colleagues to look into the matter, and the result of a great deal of experience, and partly of calculation, was what he had stated. With regard to the novel pole of the Callender Cable and Construction Co., the main difficulty that he had respecting any steel structure—especially a tubular steel structure—was that that they could not get inside it to protect it from corrosion. The discussions in the Sections showed that there was the most extraordinary differences of opinion upon the use of high tensile strength steel. He thought there must be united pressure by local authorities upon headquarters. He was not aware that concrete poles had ever been used in this country upon high-tension lines. In regard to Mr. Burnand's observations on the effective diameter of wires and factors of safety, he did not think anybody was yet really satisfied on that point. They never knew the worst conditions they had to build for. He knew a case in which a Post Office line was 12 in. in diameter, which was, of course, quite impossible on a commercial basis.

Discussion at Manchester.

Mr. C. D. Taite strongly supported the author's suggestion of the appointment of an Overhead Lines Committee. He could not agree with the author's table of comparative costs of overhead and underground lines; usually he figured that underground cost approximately three times overhead, and in a particular case where duplicate lines were estimated for, the comparative costs were underground £2,600 and overhead £953, the pressure being 10,000 volts. The use of aluminium conductors instead of copper was open to many serious objections, amongst which could be mentioned the necessity for stronger poles and cross arms, wider spacing of the conductors due to increased sag, and special arrangements for connecting up with copper underground cables. Contrary to the author's recommendations, he used rigid clamps for tying-in conductors and had never had trouble. Some of the binders referred to in the paper appeared to require good weather and skilful erection in order to ensure satisfaction. He had always used oak cross arms, and instances had occurred where a line wire had parted from its insulator and yet maintained supply through being supported by the oak cross arm; had metal been employed a shut-down would have resulted immediately. Very little trouble had been experienced from lightning. Arresters of the static discharge type were in use, also a few aluminium arresters; the great trouble with the latter type was the need of constant attention, and until this was overcome, they could not make much headway.

Mr. S. J. Watson said that in regard to the comparative costs of overhead and underground construction he agreed with the author's figures rather than those quoted by Mr. Taite. A duplicate 6,600-volt three-phase line using 0·15 sq. in. conductor, which he had installed, showed that the comparative costs were £2,400 underground and £1,250 overhead. The only serious difficulty connected with the overhead system was the question of wayleaves. A case in point was a 200-yd. span for which a wayleave could not be obtained, necessitating a considerable detour which cost an additional £1,200. He preferred the three-conductors-per-pole system. Where earthing wires were used they should be of the same material as the line conductor, and placed at the tops of the poles so as to give more protection from atmospherics. Mr. Trotter's triangular guard was an excellent device, especially for three conductors, and could also be applied to six conductors. Copper always had a definite scrap value, but in the case of aluminium the scrap value was obscure.

Mr. J. Lustgarten considered that the factors of safety given by the author for wind pressure were too high. His own experiments and American practice showed that the pressure per sq. ft. of projected area was given by the formula $\cdot00021\ d^2\ D$, d being diameter of conductor and D velocity of wind in miles per hour. He took a wind velocity of 100 M.P.H. = 14·6 lb. per ft.,

and for 60 M.P.H. = 6 „ „

The sag of wires in cases where poles were on different levels could be derived from the following formula:—$s_1 = s\,(1 + 4\,s/H)^2$, s being the sag when the poles were on same level, H being the difference in level of top of poles, and assuming no wind. Regarding the spacing of conductors for different line pressures, the formula held good up to 100,000 volts:—d cm. $= 25 + 2{\cdot}5$ KV (R.M.S.).

Mr. J. S. Peck, referring to the formation of ice on line conductors, said it was unusual to allow a factor of safety which took care of this simultaneously with the maximum wind pressure. The tendency in the States was to work with a much lower factor of safety than quoted in the paper, and hitherto the cases of trouble due to pole breakage were few. Insulators which were very satisfactory on wooden pole lines were not necessarily so on steel towers. Protective devices for railroad crossings and public roads were gradually becoming more simple in construction. Regarding the protection of steelwork from corrosion, the practice in the States was galvanising, and in one case known to the speaker, galvanised work had stood well for 20 years. A good rough estimate for spacing of wires on account of voltage was 1 ft. per 10,000 volts, and for mechanical reasons 1 ft. per 1,000 ft. of span. Steel ground wires were in general use in the States, and they were also used as stay wires for the poles.

Mr. Hollingsworth said that in certain industrial districts he had replaced wooden poles by steel poles, and found no deterioration whatever after two years' service. "A" poles were much preferable to "H" poles, and on all lines mechanical clamps had been used with entire satisfaction. He wished to confirm Mr. Taite's remarks concerning the use of wooden cross-arms.

Mr. J. Medlyn took exception to the announcement that the powers conferred on the Postmaster-General by the Telegraph Acts

* For abstract of the paper by Mr. B. Welbourn, see Electrical Review, January 16th, 23rd and 30th.

were "almost useless." It was pointed out in the paper that annual charges in the case of overhead lines were greater than underground; this difference would be accentuated in thickly-populated areas. American practice showed that the erection of overhead power wires in cities had been overdone. The Post Office factors of safety of eight for poles and four for wires were not observed in all circumstances, deviation being quite permissible in the case of sheltered positions or very open positions. The gradual freezing of sleet sometimes increased the diameter of wires to 2 or 3 in.; a particular case was cited in which the ice taken from a 100-lb. per mile-wire weighed 12 oz. per foot. This meant a weight of 1¼ cwt. per wire on a 66-yard span, or 3 tons total for all the wires in the span. Having regard to the low frequency of breakdowns of this character, the Post Office did not consider it economical to provide a factor of safety to take care of such cases. The effect of atmospheric conditions upon stay wires required careful consideration. Regarding the inclusion of telephone wires in underground transmission cables, he pointed out that whereas standard speech transmission could be obtained over 25 miles using conductors weighing 20 lb. per per mile with paper strip and air insulators, the use of rubber or gutta-percha insulation considerably reduced the distance. The termination of two wires on a single insulator was open to objection both in regard to surface leakage in wet weather, and spider webs, all of which interfered with ringing as well as speaking efficiency.

Mr. J. A. Morton referred to the B. of T. figures for windage and factors of safety, and said that if these figures were good for the most severe cross-country work, then they were much higher than necessary for overhead lines in small towns and villages. The existing rules in many cases demanded such costly construction that developments were retarded, and even jeopardised, in the case of small undertakings. They practically debarred the use of standard single-wood poles, which were cheap, looked well, took up little space, could be solidly planted, and allowed the use of simple bracket-arms. Contractors were compelled to use very stout poles in order to get the required diameter. The result was high cost and ugliness. Regarding resistances in the earth side of horn arresters, the natural impedance of any overhead circuit was given by $\sqrt{L/C}$, and this varied in practice between 250 and 500 ohms. In any single horn gap the earth resistance should not be less than twice the natural impedence, otherwise the interruption of the earth current might set up high-frequency oscillations and cause damage. On the other hand, if the earth resistance were much greater than twice the natural impedance, it might be too great to afford relief to the line. He advocated legislation making it possible to obtain cross-country wayleaves quickly, and on reasonable terms.

Mr. J. Drummond Paton said that for a given line two tons of copper at £60 would be required against one ton of aluminium at £85. The necessity for longer poles, &c., had been referred to, but practice had shown that the increase in price due to this necessity was about 15 per cent., which did not approach the economy in conductor cost. Regarding scrap values, a case actually occurred where aluminium was sold at a price in advance of the original cost. Regarding the corrosion of aluminium, a very high standard of purity had been attained, and the corrosive effect had virtually been annihilated.

Mr. A. F. W. Richards said that he could not understand how the author made out the cost of an 11,000-volt line to be equal to that of one for 20,000 volts. He knew of cases where the circumstances were such as to make the cost of overhead work as much as underground. Aluminium should not be overlooked when its cost compared favourably with copper after allowing for longer poles and cross arms. Favourable comparisons could not be made under 0·1 sq. in. copper conductor, and since this was a large area for high-pressure working, it was unlikely that aluminium would come into general use for long high-pressure lines in the near future. Butt welding was the only satisfactory method of jointing aluminium, and probably for this reason the extended use of insulated aluminium cables had been prevented. Regarding line clips, he had recently inspected a large number of these after being in use on a 0·15 sq. in. standard copper line for nearly two years. The clips were of the rigid type, and in no case was there any sign of the glazing being chafed or chipped, nor was there any trace of crystallisation of the metal. The rigid clamp was in his opinion the best method of tying up conductors. The "Elder" suspender certainly got over the longitudinal movement of slings supporting cables, but the eyelet was an objection, and would sooner or later pull through the leather thongs. The speaker preferred the hook and wedge pattern, using a very broad seating for the cable itself. This broad seating consisted of a lead strip braided with served jute, which prevented the cable slipping through, but allowed the hook to slide along the suspension wire, thereby permitting the cable to be "drawn in" between poles without any trouble. Guarding was one of the most difficult problems of overhead work, and he considered that lines protected by a device such as the Merz-Price might reasonably be left unguarded on country roads. The triangular net guard was delightfully simple and effective.

The Author, in reply, said the comparative costs of overhead and underground work given in the paper were obtained from work actually carried out under difficult conditions, and a mean figure had been taken. Regarding aluminium, this was only recommended on account of the lower first cost of line. With regard to cross-arms, the Board of Trade were quite disposed to consider any particular case, and their regulations were intended to be a record of the best general practice. Rigid clamps might prove quite satisfactory for two years, as stated by one speaker, but the proper test would be eight or ten years' service. There was a growing movement in regard to wayleave concessions, and pressure would have to come from the local sections, as in London overhead lines were of little importance. The author had inspected a mountain line in Bulgaria where lightning storms had rendered much havoc until Moscicki condensers were installed. Since the introduction of these condensers, the trouble had almost entirely ceased. The use of steel poles in America had been successful, chiefly on account of the dry atmosphere, but in the British Isles the climatic conditions were such as to cause much trouble with steel structures. Maintenance charges had been referred to by Mr. Medlyn, and recorded figures showed these to be from 2 to 3 per cent. per annum.

A VARIABLE CONDENSER WITH A SQUARE LAW.*

By W. DUDDELL, F.R.S.

Continuously variable condensers are in considerable use, especially in connection with wireless telegraphy. In using these condensers for the purpose of measurement it often happens that the quantity to be measured is proportional to the square root of the capacity of the condenser; for instance, in wave-meters of the Donitz type, which consist of a fixed self-induction and a variable condenser, the condenser being set to resonance, the wave-length is approximately proportional to the square root of the capacity of the condenser. For this reason it would be convenient in many cases, if the capacity of the condenser were proportional to the square of the distance traversed by the moving part.

Rotating-sector condensers, consisting of a number of plates or sectors which move in and out between a number of fixed ones, are often used in wireless telegraph receivers. In this case the capacity, except near the extreme ends of the scale, is very nearly proportional to the angular displacement of the moving plates.

A number of experimenters have recognised the advantages, in certain cases, of what may be termed a square-law variable condenser; and various arrangements have been proposed and constructed to attain this result.

There are a number of possible combinations of curves which give the required results. We have two sets of plates to deal with, and in what follows it will be assumed that the moving plates are fixed to a spindle, and are capable of rotation through an angle of approximately 180°, and that during this rotation the moving plates enter between the fixed plates, at a constant perpendicular distance from the latter.

The capacity of the condenser is proportional to the area of the moving plates that are within the fixed ones, plus a small correction due to the edge effect. In its simplest form the problem is, therefore, to design the shape of the edges of the plates, so that the area of the moving plate enclosed by the fixed plate is proportional to the square of the angle through which the moving plate is rotated.

In choosing between the various types two considerations have guided the author to adopt the type shown in fig. 1. First, it is essential that the moving plates shall be mechanically strong; secondly, the capacity of the condenser when the pointer is at zero must be made as small as possible. It is usual with sector condensers, in order to make the capacity perfectly definite at low values, to line the case with conducting material, and to connect the fixed plates and the interior conducting surface of the condenser together. It is therefore necessary, in order to have a low zero capacity, that the moving plates should have as little outside surface, and should be kept as far away from the case as possible.

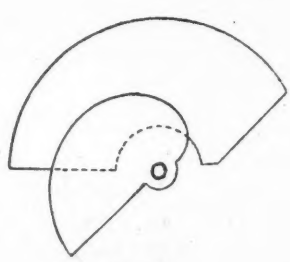


Fig. 1.

In this respect the type shown in fig. 1 is good, compared with other types. The calibration curve of the condenser can be very closely represented by a formula of the form—

$$\text{capacity} = a + b\,\theta + c\,\theta^2.$$

In an actual case, $a = 0{\cdot}025$, $b = 0{\cdot}0035$, $c = 0{\cdot}0659$. Although it has not been possible to get the initial capacity "a" as small as one would like, nevertheless the condenser has proved very convenient in use.

* Abstract of paper accepted for publication in the *Journal* of the Institution of Electrical Engineers.

ELECTRIC WINDING GEARS AT COLLIERIES.

At the meetings of the East and West of Scotland branches of the Association of Mining Electrical Engineers, Mr. James Gillespie, of the Pumpherston Oil Co., Mid-Calder, read a paper on "Electric Winding Gears at Collieries," which has given rise to much interest and discussion. The author, in the course of his paper, said that frequently they found that at a pit at which the entire output was holed, conveyed, hauled and finally screened by electrically-driven machines, an expensively-operated battery of boilers was retained solely for the generation of steam for the winding engine. There was every reason to believe that in a great many cases the electric winder offered the more economical system, and it was in all cases safer, more easily controlled and as rapid as its old-established rival—the steam winder.

Mr. Gillespie described at length the electric winders which had been installed at the Cobbinshaw Pit (Tarbrax) and the Briech Pit, belonging to the Pumpherston Oil Co. He said that the more modern electrical winder at Briech cost £3,000, and the costs might be tabulated as under:—

Power for 120,000 tons	£300
Interest at 5 per cent. on £3,000	150
Depreciation at 10 per cent. per annum ...	300
Wages for three attendants	375
Supervision, oil, stores, &c.	50
	£1,175

The rate of depreciation quoted above allowed for the set being free from debt in 10 years, although there was every reason to suppose that its useful life would be many times that period. The total of £1,175 worked out at 2·35d. per ton raised.

It would be safe to assume that a steam winder, including boiler, pipe range, feed pump, &c., could not be installed at a less capital cost than £1,500. It would consume 56 lb. per shaft-horse-power, or 2,125 tons of "duff" per annum. They might therefore tabulate the annual costs as follows:—

2,125 tons "duff," at 4s. per ton	£425
Interest at 5 per cent. on £1,500	75
Depreciation at 10 per cent. on £1,500 ...	150
Engine-keepers' wages (three)	375
Stokers' wages (two)	185
Stores, oil, firebars and supervision ...	100
	£1,310

This total was considerably in excess of the total for electric winding, the cost per ton raised being 2·62d., or 11·4 per cent. greater.

In these days of strenuous foreign competition, he considered it would repay any company working a number of small collieries, at a low margin of profit, to go in for electric winding.

At the monthly meeting of the East of Scotland Branch on Friday last, the author, in the course of a supplementary statement, said that the Ilgner system of winding which was in operation at the colliery at Breich, at first glance appeared to be somewhat complicated, but in spite of its several commutators, ran with such regularity as almost to induce the belief that the science of machine design had reached finality in this direction. The discussion was adjourned pending a visit by the members of the Branch to the winder at Breich Colliery.

At a meeting of the Mining Institute of Scotland, discussion was resumed on the paper by Mr. Willoughby M. Dunn, who described the electrical winding plant at South Kenmuir Colliery. A summary of the paper has already appeared in the Electrical Review. In opening the discussion, Mr. A. B. Muirhead, Glasgow, said that an electrical winder was applied to winding in a shaft of 20 fathoms depth, in the year 1890, and was still in use a year or two ago. The economic conditions prevailing in the coal fields of Germany and Belgium made it possible and desirable to introduce electrical coal winding long before the question was brought home forcibly to coal owners and officials in this country, but they had now reached that stage when the matter could be considered from many points of view. Shaft depths and outputs to be raised varied in almost every case, and on the other hand, the source of the electrical power and the conditions of supply varied considerably, and these played a most important part in deciding not only the system that might be adopted, but the commercial aspect of the question as well. He congratulated the author on his firm's courage in introducing this comparatively untried system into Scotland, and on the success attending the plant. He had paid attention to the system adopted at South Kenmuir Colliery, and had been attracted by the apparent simplicity of working and ease of control, together with the measure of reliability and obvious efficiency to be obtained by it. He was of the opinion that where commercial considerations justified its adoption, it would give satisfactory results. The purely rotary motion of the electrical motor combined with the ease with which the motion was controlled, made it an ideal machine for starting up against full load and gave it a great advantage over the heavier and more ungainly reciprocating engine. The steam winder must be placed near the boilers that supplied it with steam, but the electrical winder was independent of this restriction, and for this reason it was not fair to either type to make a comparison from the point of view of first cost only. The choice of the system of winding depended as much on the conditions of power supply as the conditions of winding, and both must be considered if the best result was to be obtained.

THE EMPLOYMENT OF POWER IN H.M. POST OFFICE.

At a meeting of the Scottish Local Section of the Institution of Electrical Engineers in Glasgow on January 18th, Mr. H. C. Gunton's paper was discussed. The paper was abstracted in our issue of January 9th, p. 77.

Mr. Pullen, postmaster, Glasgow, indicated that they hoped soon to have introduced in Glasgow a number of the ideas referred to by Mr. Gunton.

Mr. Wm. M'Whirter, Glasgow, thought the scheme submitted that night suggested a general Post Office electrification.

Mr. W. W. Lackie (Glasgow) pointed out that one could never dissociate the use of electrical energy in the Post Office from the name of Sir William Preece, who had the principal post offices throughout the country lighted by electricity, and thereby was of considerable assistance to the electrical industry when such assistance was much needed. The curves given by Mr. Gunton on hydraulic and electric lifts removed all doubt as to whether an electric or a hydraulic hoist was best for an ordinary office property, as the number of journeys in such a property was certainly 100,000 per annum. He demurred to the Post Office officials putting down a private station for themselves of comparatively small size. If the author looked further into the cost of electric cooking he would be saved the trouble of looking further at steam plant. With electric cooking installed the equipment would be complete.

Mr. A. Page (Glasgow) said that the battery must be a very large one indeed before it could take up 1,250 kw. Discriminating relays in their experience in Glasgow were not satisfactory and they were tending to do away with them instead of adding to them. How had the author found the earthing of the neutral point at 6,500 volts? They did not think that that was necessary in Glasgow, for they generally managed to get there when they had to earth upon one side, but that presupposed that the insulation on the other two phases was very good. The daily load factor was given as 70 and the weekly as 56 or 59 per cent. It would be interesting to hear what the yearly load factor was, as that was the factor which counted. The curves in connection with lifts might save them recommending electric plant in the future, and it might be better to leave the field to the hydraulic engineer. He did not think that there would be many cases of that kind, but one bad result led to a good deal of talking, and that must be avoided.

Mr. Stevenson (Glasgow) asked the author why he adopted different types of converting machinery in the various sub-stations.

Mr. Gunton, in his reply, said that the 1½d. per unit was the cost of every unit delivered for lighting and power. Their cost in Glasgow General Post Office was below this, and they used their exhaust steam for cooking purposes. They were, however, going to close down their station, and take a supply from Mr. Lackie. While they used exhaust steam for cooking, he had been following the matter closely, and he thought they would justify electric cooking as being cleaner. As to Mr. Page's points, the transference of the load to the battery was quite automatic. Synchronising was effected by telephone communication with the power house, and they never had any difficulty in switching in. In the case of the pneumatic plant, they tested for gas periodically, and when it was found they stopped pumping through the system and turned the connection with the vacuum into air instead of compressing the air again to the operating pressure. They had, in addition, fitted explosion doors and duplicate mains, and kept them quite free from oil deposits likely to cause spontaneous combustion. He had the two different types of transforming machinery in the sub-stations for two reasons. The pure alternating current was the most efficient. On the other hand, it had a low power factor. They wanted a continuous current for supply purposes, and continuous current was more suitable for driving compressors. They were faced with the fact that some offices wanted both. He used three-phase motors for driving lifts and conveyors, and then put all the continuous-current plant in one sub-station together with the battery. By using motor converters as a power factor corrector, they could have a high efficiency on the whole system, and at the same time the advantages of the battery as a stand-by.

Wireless Station Wrecked.—Wind and frost were the causes of a recent temporary breakdown of the wireless station just erected by the Hochfrequenz Maschinen A.G., at Eilvese, in Hanover. The antennæ were fixed to a 21-ft. wooden mast, surmounting a 250-m. high iron latticework tower. The result of a severe frost in the night-time was the coating of the wires with ice to fivefold the thickness of the wire, the weight of which under the stress of a violent eastern gale on the following day led to the downfall of the whole of the wood and wire superstructure. The action of the frost was unexpected, and measures will be taken to prevent the wires being similarly frozen in future. There is no question of interrupted service, as the station, not having yet left the hands of the contractors, is without its official licence. It is intended eventually to fix to the wooden mast a revolving light for the protection of the tower against, and as a landmark for, night-flying airships.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

GERMANY.—The Prussian Minister of Finance has issued a circular pointing out that the proper method of obtaining authoritative information as to rates of duty is to apply to the Directionsbehörde des Zollamts to whose district the goods are to be cleared for consumption. If, either in cases of great urgency, or when the matter appears to admit of no conceivable doubt, other Customs officers answer inquiries addressed to them otherwise than in the formal manner prescribed, it must be expressly on the understanding that the information given is not binding.

GREECE.—The Board of Trade have received details of the new rates of duty on certain goods imported into the old and new territories of Greece, in accordance with the Bill recently drawn up. The duties proposed are to be levied in the new territories as from the date of the introduction of the Bill into the Chamber. Article 3 of the Bill provides that the following goods which are free of duty under the existing Greek tariff should also be exempt from duty in the new territories:—Dynamos and inseparable accessories thereof; industrial machinery and parts thereof; metallic wires for telegraphs and electric bells; rails and their connecting portions; wire of iron, steel, or any other common metal unwrought. It is provided that exemption from duty may, by Royal Decree, be extended to other articles imported into the new territory, as far as such articles are free of duty under the Greek Tariff. All goods other than those specially provided for in the Bill, on importation into the new territories, are to pay a duty of 15 per cent. *ad valorem*. Other alterations in rates relate to goods which are not of interest to the electrical industry.

AUSTRALIA.—Recent applications for the alteration of the tariff, which have been made to the Inter-State Commission, include an application for the reduction of the existing duty of 6d. per lb. on trade catalogues, and one for the extension of a preference to British catalogues. Representations to the Commission in connection with tariff investigation must be on printed forms obtainable in London from the High Commissioner for Australia, Victoria Street, S.W. Such representations should be made as promptly as possibly.

VENEZUELA.—The Board of Trade report that a circular recently addressed by the Venezuelan Minister of Finance to the Venezuelan Consuls abroad, informs them that in cases where Consular invoices covering goods intended for shipment to the Republic are presented for certification shortly before the departure of the vessel, so that no time remains to ascertain whether such invoices embody all the particulars required, the Consuls are to warn shippers of the penalties incurred by reason of errors or omissions, and if the shipper accepting the responsibility, insists on the certification of the invoice in these circumstances, the Consul is to endorse the document as follows: "No revisada por haber sido presentada—horas antes de la salida del buque (Not revised owing to presentation—hours before the departure of the vessel)."

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,394. "Wire-Drawing Machines." R. D. CONNOR. January 19th.

1,395. "Methods of Protecting Electric Feeders and the Like." E. G. WATERS. January 19th.

1,405. "Continuous Current Generators." FRIED. KRUPP AKT-GES. January 19th. (Addition to 1,407/13. Convention date, January 31st, 1913. Germany.) Complete.

1,421. "Method of and Means for the Production of Light from High Tension Magneto Machines Used for Ignition Purposes." A. E. TWIDDY and J. STALLY. January 19th.

1,437. "Process for the Electrolytic Production of Malleable or Forgeable Iron." E. F. K. HARBECK and B. LAN. January 19th. (Complete.)

1,452. "Overhead Conductors of Electric Railways." KALMAN VON KANDO. January 19th.

1,495. "Racing Preventer and Regulator (Electrically Controlled) for Steam and Other Engines." I. SMITH. January 20th.

1,514. "Apparatus whereby the Position of a Sunken Vessel (such as a Submarine) can be Located and Telephone Communication Established Between Those in the Vessel and Those Above Water." A. BUTLER. January 20th.

1,548. "Telegraphic Printing Receivers." J. B. NIGRON. January 20th. (Convention date, January 21st, 1913, France.) (Complete.)

1,549. "Electric Switches, Commutators, and the Like." P. E. MORAND. January 20th.

1,553. "Manufacture of Cemented Mica Plates." MICANITE AND INSULATORS Co., LTD., and A. G. ELLIOTT. January 20th.

1,556. "Control of Moving Bodies by Radiant Energy." J. H. HAMMOND, JNR. January 20th. (Convention date, January 21st, 1913, United States.) (Complete.)

1,587. "Fittings for Electrical Conduit Systems." D. L. J. BROADBENT. January 21st.

1,606. "Life-Guards or Safety Appliances for Use with Electric Tramcars and Other Vehicles." H. EZARD. January 21st.

1,607. "Electric Desk-Lamps." M. J. D. CARTER. January 21st.

1,632. "Sparking-Plugs for Internal-Combustion Engines." J. J. WELDON. January 21st.

1,640. "Arrangements for Regulating the Torque of Polyphase Electric Motors." SIEMENS-SCHUCKERTWERKE G.M.B.H. January 21st. (Convention date, January 22, 1913, Germany.) (Complete.)

1,641. "Automatic Switches for Use in Telephone Exchange Systems." WESTERN ELECTRIC Co., LTD. January 21st. (Franklin Tuthill Woodward, Belgium.) (Complete.)

1,651. "Telephones and the Like." E. O'TOOLE. January 21st.

1,691. "Electric Lamps and their Fittings." H. E. SHEWARD. January 21st.

1,697. "Appliance for use in Radio-Active Treatment." G. BARNETT. January 21st. (Vernon C. Ward, United States.)

1,715. "Magnet Pole-Pieces of Telephone Receivers and the Like." A. MARR. January 22nd.

1,729. "Connections and Fittings for Electric Conduits." C. BIRCH. January 22nd. (Complete.)

1,748. "Electric-Lighting Systems for Moving Vehicles and Apparatus therefor Applicable Wholly or in Part to Other Purposes." J. NEALE. January 22nd.

1,757. "Electropathic Wearing-Apparel." S. J. ROSS and H. SCHOFIELD. January 22nd.

1,758. "Electric Ignition for Internal-Combustion Engines." G. INRIG and L. INRIG. January 22nd.

1,779. "Thermal Relay." H. FAIRBROTHER. (Thermo Electric Instrument Co., United States.) January 22nd. (Complete.)

1,786. "Fluid Rheostats." IGRANIC ELECTRIC Co., LTD. (Cutler Hammer Mfg. Co., United States.) January 22nd. (Complete.)

1,792. "Circuit Arrangements for Telephone Systems." SIEMENS & HALSKE AKT.-GES. January 22nd. (Addition to 22,013/10. Convention date, January 25th, 1913, Germany.) (Complete.)

1,828. "Steering and Other Compasses." W. D. WHYTE. January 23rd.

1,850. "Electric Cables." J. F. WATSON AND CALLENDER'S CABLE AND CONSTRUCTION Co, LTD. January 23rd.

1,851. "Manufacture of Electric Cables." J. F. WATSON AND CALLENDER'S CABLE AND CONSTRUCTION Co., LTD. January 23rd.

1,854. "Means for and Method of Changing the Frequency of Alternating Electric Currents." A. M. TAYLOR. January 23rd. (Addition to 8,853/11.)

1,856. "Typewriting Telegraph Transmitters or the Like." SIEMENS BROS. AND Co., LTD. January 23rd. (Siemens and Halske Akt-Ges, Germany.) (Complete.)

1,871. "Circuit Arrangements for Telephone Systems." SIEMENS AND HALSKE AKT-GES. January 23rd. (Addition to 28,751/13.) (Convention date, January 25th, 1913, Germany.) (Complete.)

1,877. "Electrical Instruments." R. D. GIFFORD AND NALDER BROS. AND THOMPSON, LTD. January 23rd.

1,890. "Means for Transforming Mechanical or Electrical Energy into Heat." PINTSCH'S ELECTRIC MFG. Co., LTD., AND C. H. VIDAL. January 23rd.

1,891. "Process of Rolling Metal." S. O. COWPER-COLES. January 23rd.

1,892. "Process for the Electro-Deposition of Lead." S. O. COWPER-COLES. January 23rd.

1,893. "Process for Coating or Plating Metal Sheets with Other Metals." S. O. COWPER-COLES. January 23rd.

1,968. "Telephonic Receivers." WESTERN ELECTRIC Co., LTD. (Franklin Tuthill Woodward, Belgium). January 24th. (Complete.)

1,969. "Telephone Systems." AUTOMATIC TELEPHONE MFG. Co., LTD., AND F. NEWFORTH, JNR. January 24th.

1,970. "Telephone Systems." AUTOMATIC TELEPHONE MFG. Co., LTD., AND A. B. SPERRY. January 24th.

1,972. "Dry Cell Batteries." C. W. SIMMONS. January 24th. (Complete.)

1,975. "Motor Controllers." G. R. RADLEY. January 24th. (Convention date, January 25th, 1913, United States.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

8,144. PROCESS OF MANUFACTURING RESISTANCES FOR ELECTRICAL HEATING APPARATUS. C. O. Bastian. April 4th (October 4th, 1912).

22,621. METHOD OF PRODUCING CONDENSATION PRODUCTS OF ALDEHYDES. E. C. R. Marks. (E. I. du Pont de Nemours Powder Co.). October 4th.

27,859. MANUFACTURE OF TUNGSTEN. C. Gladitz. December 3.

27,956. SWITCHING DEVICES FOR STARTING MERCURY VAPOUR OR OTHER ELECTRIC LAMPS, ELECTROMOTERS, AND THE LIKE. G. W. Johnson (W. C. Heraeus Ges.) December 4th.

1913.

43. APPARATUS FOR ELECTRICALLY OPERATING PLANING MACHINES, AND THE LIKE RECIPROCATING TOOLS. Lancashire Dynamo and Motor Co., A. P. Wood and R. S. McLeod. January 1st. (Cognate application 16,792/12).

416. CHANDELIERS AND LIGHTING FIXTURES. W. H. Fisher. January 6th. (January 6th, 1912.)

444. RESONATING RELAYS. H. von Kramer and G. Kapp. January 7th. (Patent of Addition not granted.)

465. MAGNETOMETERS, COMPASSES, AND THE LIKE. R. W. Paul. January 7th.

736. RADIATING SYSTEM FOR SIGNALLING BY ELECTRIC WAVES FROM AEROPLANES. Signal Ges. January 9th. (February 24th, 1912.)

790. MOTORS FOR USE CHIEFLY IN CONNECTION WITH TELEGRAPH TRANSMITTERS. J. S. Withers (Cox and Dicketts). January 10th.

791. AUTOMATIC TELEGRAPH TRANSMITTERS. J. S. Withers (Cox and Dicketts). January 10th.

843. LAMPS FOR MOTORS AND LIKE VEHICLES. R. A. Oldfield and J. and R. Oldfield, Ltd. January 10th.

1,223. AUTOMATIC TELEPHONE EXCHANGE SYSTEMS. Western Electric Co. (Wohler). January 15th.

1,278. ELECTROMAGNETICALLY-OPERATED DIAPHRAGMS FOR PRODUCING SOUND. E. A. Graham. January 16th.

1,281. SPARK PLUGS. C. H. Duffy. January 16th.

1,862. EARTHING CLIP. F. Townson. January 23rd.

2,361. ELECTRIC-CONTACT MAKERS. L. Clempson and A. E. Murrell. January 29th. (February 7th, 1913.)

2,417. INSTRUMENTS FOR MEASURING THE FLOW OF FLUID THROUGH A CONDUIT. British Thomson-Houston Co. (General Electric Co.). January 29th.

3,539. METHOD OF AND APPARATUS FOR INCREASING THE EFFECT OF VARIATIONS OF ELECTRIC CURRENT. A. C. Fuller. February 11th.

4,225. DEVICE FOR HOLDING A COIL OR COILS OF INSULATED OR OTHER WIRE WHICH IS BEING USED IN THE INSTALLING OF ELECTRIC LIGHTING, BELL, TELEPHONE, AND LIKE SYSTEMS. H. W. Brotherton. February 19th.

5,158. REGULATORS FOR DYNAMO-ELECTRIC MACHINES. J. R. Johnstone and T. Ferguson. March 1st.

5,199. ELECTRIC ARC LAMPS FOR PROJECTION. A. Schmidt. March 1st.

6,176. IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. W. J. Mellersh-Jackson (Stringham and Elmendorf). March 12th.